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The Shipbuilding Situation

OWING to the destruction of nearly 2,000,000 tons of shipping since the outbreak of war in Europe, and the withdrawal of a considerable portion of European shipping from commercial service, urgent demands for new tonnage have rapidly spread throughout the world, bringing to the shipbuilders of all neutral countries a period of unprecedented prosperity. This impetus to shipbuilding has been strengthened by the virtual cessation of merchant shipbuilding in the warring countries, which heretofore were the largest producers of merchant tonnage in the world, and by the extraordinary opportunities offered for realizing handsome profits either by the sale of vessels built on speculation or by the operation of vessels at very remunerative rates in the general cargo trade.

Nowhere have the results been more pronounced than in the shipyards of the United States. After many years of comparative inactivity, American shipbuilders were suddenly confronted with a volume of business calling for an immediate increase of working forces and a general speeding up of the output of the yards to make way for the taking of new contracts at abnormal prices. To take advantage of the business offered many of the yards found it necessary to add materially to their equipment and provide additional building facilities, as is described elsewhere in this issue. With the continued increase of orders, however, difficulty was experienced in securing early deliveries of steel, with the result that contracts for new vessels recently placed in most of the yards have been contingent not only upon the availability of building berths, but also upon the delivery of steel for the construction of the vessels, a factor which has undoubtedly restricted to a certain degree the legitimate expansion of some of the shipbuilding facilities. Difficulties in securing skilled shipyard labor have also placed the shipbuilders in a position where it has become necessary to resort to the training of inexperienced employees in the yards for the special class of work required for shipbuilding.

Aside from the fact that the present favorable conditions will undoubtedly continue as long as the war lasts, and probably for a limited period after hostilities are ended, the future expansion of the American shipbuilding industry depends upon the establishment of a definite policy for upbuilding the American merchant marine for foreign trade. With few exceptions the merchant tonnage now under construction is for domestic use. Not until shipowners can be assured of some definite national policy by which the American merchant marine can attain a permanent growth in overseas trade will the shipbuilding industry in the United States be placed on a sound basis for its future expansion.

While the present situation may tend to more nearly equalize the costs of construction of American and foreign-built ships, owing to the higher costs abroad and the opportunity which American shipbuilders now have, on account of a large and constant volume of production, to standardize the building of special classes of ships, this factor alone will not restore the American flag to the high seas. It is only by means of a definite policy of positive government protection for American shipping that our former commercial supremacy at sea can be regained.

How such protection shall be furnished and applied—if it is forthcoming—rests entirely with Congress. Many excellent suggestions from men who have spent years in the shipping or shipbuilding business are given in the following pages. In most of the legislation that has so far been proposed, however, one feature at least which has met with general approval predominates. This is the establishment of a Federal shipping board invested with sweeping powers for the direction of American marine affairs. One of the first duties of such a board would be to investigate the relative costs of building and operating ships in this country and abroad and to prescribe remedial measures by which this obstacle could be overcome. Following this it should recommend revisions of the United States navigation laws and the removal of restrictive legislation affecting the American merchant marine. With some of the obstacles to economical operation of ships removed and an authoritative body of men to recommend to the administration the kind of legislation that will provide the necessary protection to American shipping, it is believed that an American fleet for foreign trade will be developed.

National Protection Necessary

Without the development of an American merchant marine for foreign trade, the future of the American shipbuilding and shipping industries will be but a repetition of the inactivity of the past twenty-five years.

As the present revival of American shipbuilding is a direct result of abnormal conditions caused by the European war, to rely solely upon these conditions for the restoration of the American flag upon the high seas is to leave the matter to fate.

To develop an adequate merchant marine for overseas commerce the United States must give positive national protection to American shipping.

The Shipbuilding and Shipping Situation

Views of Leaders in the Marine Field on Business Conditions and the Upbuilding of the American Merchant Marine

NEVER before in this generation have conditions in the marine field been more favorable for American shipbuilders and shipowners. Practically every shipyard in the country is filled to capacity with work at top prices for at least two years, and in most cases for a longer period. In almost every case the facilities of the yards for building ships have been enlarged, the working forces increased, new shops built and new machinery and equipment added. Several new shipbuilding companies have entered the field, a number of old and obsolete shipyards, idle for many years, are being put in shape for business, and on every hand large sums of money are being invested in the various marine industries with excellent prospects for profitable returns.

This unprecedented situation, however, is practically independent of any extension of the American merchant marine in foreign trade. Except for those vessels building for special industries whose interests are international and those building for foreign owners, the work now in hand is practically all for domestic use. It is to the development of the American merchant marine for foreign trade that thinking men are now looking for the future expansion of the shipbuilding and shipping industries in the United States. That this can be accomplished without direct government aid and encouragement is unbelievable, and events of the past eighteen months have shown conclusively that the time has come when definite action must be taken by Congress to overcome the obstacles that are keeping the American flag off the high seas.

SHIPPING AND SHIPBUILDING INDUSTRIES MUST BE PROTECTED

STEVENSON TAYLOR, PRESIDENT SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS

According to all reports, public and personal, the condition of business in the marine field is exceedingly prosperous, owing to the conditions existing among the other nations of the world.

No one can exactly foretell what the future prospects may be, so much depends on the conditions in Europe at the close of the present war. My faith in the future of the United States compels the belief that the American people will not be satisfied without a merchant marine under the Stars and Stripes—one commensurate with the importance of this nation.

The obstacles and hindrances in the form of unwise and class legislation, such as has prevailed during the past few years against railroads and shipping interests, must be removed.

Apparently a change in the sentiment of the people is becoming prevalent and will naturally be observed by legislators. The next general election will, without doubt, emphasize this change. If so, legislators will endeavor to conform thereto and they will repeal at least some of the objectionable features of existing legislation.

If, however, the existing shipping laws are continued until after the end of the European war, it is possible that a large proportion of the newly formed American merchant marine will seek relief by obtaining registration under the flag of some other nation whose laws help, not hinder, the promotion of shipping.

As to the financial side of this inquiry, if legislation is made to conform more nearly to the customs of other nations, at least to the extent of not making prohibitive the operation of ships on account of excessive cost, an acquaintance with the possibilities of a marine service will doubtless be made by bankers and capitalists so they will not be so chary of shipping investments. Such an acquaintance will result in promotion of larger shipping enterprises than have been heretofore proposed.

One other financial need is that of insurance, which should be provided in the United States to cover the building and operation of at least all of our own ships. This involves also a classification system which will deserve the confidence of the world. A movement is now on foot to provide such classification and insurance.

The shipping and shipbuilding industry should be protected as are other industries. It seems hopeless that any such legislation will be provided, so it can only be said, give relief from the unfortunate recent legislation and then let shipbuilders and shipowners alone for a few years, so they may meet the inevitable competition on a fair basis.

COMPREHENSIVE SUBSIDY LEGISLATION ADVOCATED

JOSEPH W. POWELL, PRESIDENT FORE RIVER SHIPBUILDING CORPORATION

At the present time every shipyard in every neutral nation the world over is full of business, and this condition will obtain not only so long as the war lasts, but for at least a limited time after peace again exists. What the situation will be thereafter no man can foresee, but the longer the war lasts and the greater its cost to the nations involved, the more nearly will the shipbuilding business in this country be placed on a plane of equality with the English and German yards. To count solely on this war as a means to restore our flag to the ocean is to leave this matter to fate.

The soundest and surest way to create a vigorous American merchant marine in overseas trade is to grant subsidies—and moderate amounts will suffice—to regular

liners from 14 knots upward on fixed postal routes, and subsidies to good cargo vessels sufficient to equalize costs of construction and operation between our ships and their foreign competitors. These subsidies should be conditional upon fitness for naval auxiliary service in time of war, and upon the building of the ships in American yards. This policy will promote our commerce and at the same time conserve the national defense. In a conflict with a great power the commercial shipyards of this country would be indispensable for naval construction and repair work, and as essential to the national safety as gun and armor plants and powder works.

The government can properly encourage shipowning and shipbuilding as it has encouraged manufacturing, but there is no more need that it should go into the shipowning or shipbuilding business than that it should embark in the making of steel rails or cotton cloth. Government participation in any business inevitably discourages private capital and enterprise from entering it, and consequently reacts harmfully on the development of business.

An intelligent revision of our shipping laws, under the guidance of men who have broad, practical knowledge of the shipping business, ought to be made a part of any effort to restore our merchant marine. But such a revision alone will not suffice, as witness the results of a suspension of the navigation laws on foreign-built vessels just admitted to American registry. The foreign officers and crews of these naturalized ships immediately demanded American wages and the American food scale and secured them, so that the cost of operation of these foreign-built steamers is exactly the same as the cost of operation of American-built ships.

The "free ship" policy, tried under the most favorable conditions, has already proved a failure, and the whole country must now recognize the need of comprehensive subsidy legislation for which free ships and the suspension or repeal of our navigation laws can no longer be urged as an alternative.

SEAMEN'S ACT GREATEST HINDRANCE TO THE MERCHANT MARINE

O. J. FISH, VICE-PRESIDENT AMERICAN SHIPBUILDING COMPANY

The present conditions of business in the marine field, as affecting the American Ship Building Company, are exceptionally good, due to the heavy demands on the Great Lakes' carriers, and also the possibility of salt water construction capable of St. Lawrence Canal passage.

Future prospects promise well, inasmuch as the demand for all kinds of steel products are taxing the ore fleet of the Great Lakes to the limit of their capacity, with no signs of abatement at present.

We consider the effects of the passage of the Seaman's Act the greatest hindrance to the permanent growth of the merchant marine.

All legislation should be the result of deliberations of a body of men familiar with the operation of vessels; for instance, a commission in whose hands the welfare and safety of passengers will be assured, as well as the development and upbuilding of a fleet which will be a credit to the country.

PRESENT DEMAND FOR AMERICAN MERCHANT VESSELS UNPRECEDENTED

WILLIAM A. DOBSON, NAVAL ARCHITECT, WILLIAM CRAMP & SONS SHIP & ENGINE BUILDING COMPANY

The present demand for merchant ships is beyond the experience of any American shipbuilder of the present generation. Every established shipyard is full of work, some new yards have been added to those already in existence, and the air is full of rumors of new yards to be established. The cause, to a large extent, of all this is found in the demand for war materials and supplies by the warring nations of Europe, who must look to this country to supply a great part of their present needs. All of this vast amount of freight must be carried to Europe in ships, which, owing to the destruction of many by mines and submarines, the internment of the vessels of Austria and Germany, and the commandeering of a large number of vessels under the British flag for use of the Government, are limited in numbers and do not begin to meet the demand for shipping facilities. The proof of this is found in the condition of the railways leading to every seaport adjacent to manufacturing centers. The tracks and sidings are congested with freight that can find no relief except through its transference to floating carriers. Hence the feverish activity of shipyards, spurred thereto by the insistent demands of shipowners to build ships for them. This condition has given to the shipbuilding business such a roseate hue that some new yards have been built and more are seriously talked of.

The question arises then, does the future hold in prospect sufficient business to warrant an increase in the shipbuilding facilities of the country? This question must be answered in part by the records of the past, and largely by a consideration of the cause of the present activity in shipbuilding.

There can be no reasonable contradiction of the statement, that while under ordinary conditions there would be at the present time a considerable increase in the building of new ships, yet by far the greater part of the present tonnage in course of construction is the direct outcome of conditions created by the war. Therefore, if the war has created such an expansion of shipbuilding, the cessation of hostilities will cause the shipbuilding boom to shrink to a condition more nearly normal.

Three factors will be involved in this shrinkage; first, the demand for war material will cease, and that for supplies will be greatly lessened; second, the vessels of the merchant marine of Germany and Austria will be released from their present internment, and third, the vessels now taken over by the British Government for transporting troops and supplies will be restored to the merchant marine.

In addition, the shipyards of Britain will be released from the obligation to build for the Government only, and may be able to underbid American shipyards for certain classes of vessels.

It is not believed, however, that the British shipyards will ever be able again to build ships as cheaply as in the past. This will be due to the fact that wages have increased largely throughout the Kingdom, and will not again find the lower rates which prevailed before the war.

The rise in the wage rates will so increase the costs

of material and labor as to more nearly equalize the cost of production in Great Britain and in this country. The result will be the building of more ships in American shipyards.

The five large shipbuilding plants on the Atlantic Coast are ample to take care of all American shipbuilding under normal conditions, especially as there seems to be a tendency to withdraw government shipbuilding from private yards and build our war vessels at the Navy Yards.

The wisdom, therefore, of establishing new shipyards is, to say the least, debatable. The policy of building war vessels in the Navy Yards will react upon the shipbuilding industry of the country, and possibly deprive the Government of some of the facilities it now has for a rapid upbuilding of the navy.

The experience of the past is fresh in the minds of shipbuilders, when, at some periods, but few merchant vessels were on order, and the yards were kept in existence by the contracts from the Government. These contracts had been taken at low figures as a choice between closing the yards entirely, or taking the government contract at such a figure as would enable the management to keep its force together. The result was that the United States obtained its vessels at the lowest cost of any of the great navies of the world. Should the present policy of building at the Navy Yards continue, the prospects are that some of the shipyards may in hard times be forced to close. As opposed to this policy, the Government by every means in its power should foster the shipbuilding industry. For the rapid expansion of our navy, which all are beginning to see is our chief defense, our shipyards must be encouraged to provide adequate facilities for building the present dreadnoughts. The day has passed when shipyards with ordinary equipment can build these enormous vessels and handle the heavy weights of armor, guns and turrets. Special appliances are necessary, and when provided, at large expense, should be utilized by the placing of orders by the Government, at such yards as are properly equipped. The system of the lowest bidder being awarded the contract for building is not always the best, either in the interests of the Government or the people at large. It would seem a better way for the Government to select such shipyards as, in its knowledge, possess the necessary equipment, skill and engineering ability to carry on its construction rapidly and intelligently, and place the contracts with them after agreeing upon a figure satisfactory to both parties.

An adequate merchant marine is a necessity for our commercial security, and it is indispensable in the event of war, as a source from which the Government can enlarge its fleet of colliers, transports, mine layers, and other vessels necessary for the minor but all-important services.

The best and most direct means of encouraging shipbuilding interests in the United States is by subsidy to steamship lines pure and simple. The nations engaged in ocean traffic paid in 1909 total subsidies and bounties amounting to $47,000,000 (£9,630,000). The United States in 1914 paid in mail subsidies $1,089,361 (£225,000).

"A word to the wise is sufficient."

LEGISLATIVE RESTRICTIONS MUST BE REMOVED

D. H. COX, NAVAL ARCHITECT, COX & STEVENS, NEW YORK

The present condition of business in the marine field is absolutely unprecedented, both in the volume of business and in the proportion of large sea-going tonnage being ordered. Practically all the building yards, both on the coast and inland are full up on orders covering deliveries extending over a period of two years. Further, we find that many of the present yards are enlarging their facilities for building, and several other building yards are being contemplated.

As for future prospects in the marine field, this, in my opinion, depends very largely upon the continuation of the present conditions existing abroad, and on legislation relating to the owning and operating of ships in this country. As long as the present existing conditions continue abroad, there is no doubt that, even with the handicap of present legislation, vessels can be most successfully owned and operated in the United States. At the termination of hostilities whether or not this condition will exist will depend greatly upon any legislation that may be enacted prior to that time. With the present legislative restrictions, it is doubtful whether American commerce will be able to compete with foreign commerce when competition is renewed.

The obstacles or hindrances that in my opinion must be overcome to insure the permanent growth of the American merchant marine are such restrictions as are now placed upon the American shipowner and ship operator, to his great disadvantage in competition with the owners and operators of foreign-owned or operated vessels.

EXPERT SHIPPING COMMISSION ADVOCATED

CAPTAIN GEORGE A. WHITE, GENERAL MANAGER HUDSON RIVER DAY LINE, NEW YORK

We consider the present conditions as generally exceptionally good for all freight steamers, but the passenger marine has had a bad year.

The success of the lines handling freight is, in spite of, and not by aid of, governmental regulations. As to future prospects—post bellum—the government may continue the strangle hold it has maintained and strengthened so long and make every marine venture a questionable gamble in which honest money and careful men may hesitate to subscribe, or the government may, by scientific, wise and constructive action, enable the marine brains and enterprise of this country to take advantage of the golden opportunity which is now knocking so loudly at our doors.

The La Follette Seaman's Union law should be repealed and a law harmonizing the London Conference with our conditions substituted.

Finally, it does seem the part of wisdom that the government, instead of the amateurish experiment of proposing to expend upwards of $30,000,000 on a visionary government-owned and operated merchant marine, should appropriate a few thousand dollars for the employment and maintenance of a commission to be made up of the best marine brains in these United States.

Let this scientific and business-like commission be patterned somewhat after such controlling bodies in such other nations as have made a success of their marine affairs.

Let the ablest naval architects and marine engineers

(two at least) be on it, also two captains of high standing, one in the salt water trade and one in the inland trade, one chief engineer, one admiralty lawyer, two successful operating officials, one from the salt water trade and one from the inland trade, one ship and engine builder, and two men from the operating crews, one in salt water service and one from the inland service.

Let it be the prompt duty of such a commission (non-partisan) in collaboration with the Department of Commerce, to revise our present jumble of marine laws and regulations, to review pending legislation, and to provide for a permanent commission of like character to safeguard our greater marine development from the nostrums of quacks and from the selfish, dishonest attacks of vote catchers.

The great present agitation for an oversea trade should not be allowed to blind us to the acute and crying present condition of our inland marine and of the passenger marine.

Our people enjoy and demand more and more the out-of-doors pleasures, and instead of being legislated out of existence, our passenger marine service should be treated at least as well as such service is treated by other more intelligent and more successful marine nations.

DEMAND FOR LARGE SEA-GOING VESSELS GREATER THAN EVER

ARTHUR D. STEVENS, PRESIDENT MERRILL-STEVENS COMPANY, JACKSONVILLE, FLA.

At present the demand for new ships seems to be beyond the capacity of existing yards to furnish them within reasonable time, although very attractive prices are offered. This applies particularly to ocean-going vessels of the larger class. For smaller craft the demand is not so great, so that the smaller yards are not yet crowded, but the congested condition of the big yards should have the effect of throwing into the smaller plants the lighter construction which the larger yards were glad to get under previous conditions.

The demand for large vessels is at present greater than ever, but it seems to me that should the European war be brought to an end there would be turned loose for commercial use such a large number of ships now interned or used for war purposes that the demand for new vessels would at least return to normal proportions, if not less than that. On the other hand the cessation of the war would necessarily result in a tremendous demand for docking and repairing, for each ship now either interned or in war service would require overhauling before resuming commercial service.

To enable the merchant marine to compete successfully with foreign bottoms it must be accorded sufficient privileges to overcome the greater operating expense imposed on it by our shipping laws.

I believe that the admission to American registry of foreign vessels with the provision that all repairs other than emergency work should be done in American yards, and the revision of existing treaties, allowing reduction of duty on goods imported from place of origin on American-built bottoms, would build up the American marine and develop our shipyards.

I am heartily in favor of giving to American seamen all the advantages possible, but, as stated above, there should be compensation in some manner for the extra burden of expense which is thus imposed on American vessels in order that they may successfully compete with foreign vessels that do not provide so abundantly for their crews.

ADEQUATE NATIONAL PROTECTION NEEDED FOR SHIPPING

WINTHROP L. MARVIN, AUTHOR OF "THE AMERICAN MERCHANT MARINE"

This great world-war has brought to the American people in a year and a half more realizing sense of the value of an American merchant marine than they could have acquired from orators and statesmen in a half century. For one thing, the war has demolished forever the specious plea so long familiar in the newspapers and Congress that if British and German ships could carry our commerce "cheaply" they ought to be allowed to monopolize the ocean, while Americans kept at home. War has mercilessly shown that "cheapness" purchased in this way may prove to be exceedingly dear when some foreign ships are interned and useless and others imperatively requisitioned for the service of their government. Every man of intelligence now knows that depending upon foreign merchant craft to convey our trade is almost as blind and suicidal as depending upon foreign soldiers and sailors to fight our battles and protect our flag. An American merchant fleet will hereafter be understood to be what it actually is—as indispensable to the nation in every part of it as an American navy or army.

The same course which has made the need of a strong merchant shipping so manifest has also fortunately made it easier of attainment. One hundred steel steamers of ocean-going size are now under construction in American shipyards—most of them designed for coastwise commerce, it is true, but all capable of overseas service if that is required. Nearly all of these are either tank or bulk-cargo vessels. Some yards are building several on the same designs. Standardizing of product and large and constant volume of production are now practicable as never before. For the first time, American ocean yards are now *manufacturing* ships, very much as locomotives and steel cars are manufactured—and the gain is certain to be great in economy and efficiency. There will inevitably be a narrowed difference in first cost between American and foreign ships after this war has ended.

This first cost of construction has unquestionably been one great and heavy handicap upon the growth of American ocean shipping. The present policy of free registry of foreign-built ships for international commerce is an experiment—a temporary policy certain to be modified or abandoned when the protectionist party returns to full power in the United States. There will be no need or excuse for "free ships" if the cost of shipbuilding in this country can be reduced on typical cargo craft to within 10 or 15 percent of the foreign figure, which after the war will undoubtedly be substantially higher than before. A difference so small as this would be counterbalanced by the superior durability of American-built ships and their privileges of employment in the coastwise service when not required for purposes of foreign trade.

One fact of the utmost practical significance which the

"free ship" experiment has developed is that the moment that foreign-built vessels accept the American flag their wage scale and cost of maintenance rise to the American standard. This fact is testified to by the Standard Oil Company, the United States Steel Corporation and other concerns owning foreign-built ships, which were given American registry under the Emergency Shipping Act of August 18, 1914. That act authorized the suspension by the President of the law requiring that the officers of these ships thus admitted should be American citizens.

But instantly the foreign officers and crews of these newly naturalized ships demanded and secured American wages. The ships were exempted by Executive authority from compliance with our measurement and inspection laws, but nevertheless the operating expenses of these vessels were immediately increased by the hauling down of foreign colors and the hoisting of the Stars and Stripes.

W. R. Grace & Company, New York shipowners, find that wages and food of a typical steamship under the American flag amount to $2,773 (£570) a month, as compared with $1,991 (£408) under the British flag. Nine steamers of the United States Steel Corporation have been transferred from British to American registry. The 373 members of these nine crews under the Britsh flag received in wages $12,478 (£2,560) a month. The 393 members of the same nine steamers under the American flag receive $17,537 (£3,600) a month—an increase of 40.54 percent besides an addition of 19 percent to the cost of food.

"Free ships" will not give us a great mercantile marine. "Free crews" will not. This has now been actually demonstrated by experience. What is needed is vigorous, positive National protection and encouragement. This is the real, vital heart of the question of our American merchant marine—and these are the things which the nation must do:

1.—Protect the cargo ships by a National subsidy sufficient to cover the difference in wages, food and cost of maintenance between American and foreign vessels. Make this subsidy large enough to cover, if necessary, any higher cost of construction of American-built ships, and make it conditional upon the fitness of the ships for auxiliary service as transports, fuel ships, ammunition ships, hospital ships, repair ships, etc., in case of war—when they should be placed at the disposal of the government.

2.—Protect the regular mail lines against the competition of foreign lines by a liberal amendment of the ocean mail law of 1891. All foreign governments subsidize regular steamship services. We must do the same with equal generosity and perseverance.

3.—Overhaul the navigation laws and regulations of the United States, striking out all that unnecessarily hinders shipowners and compensating shipowners for the cost of all exactions which their foreign competitors do not have.

4.—Encourage the creation of a great American survey and classification service as the foundation for an adequate system of American insurance for all American ships.

5.—Establish a Federal shipping board of trained and responsible officials, which shall be to our merchant marine what the Board of Trade is to the merchant shipping of Great Britain.

It is my profound conviction, based upon many years of disinterested study of the question, that protection—adequate National protection—along the lines thus indicated will make America the chief maritime, as protection long ago made her the chief manufacturing, nation in the world.

LAKE AND SEA-GOING VESSELS REQUIRE DIFFERENT STANDARDS

JAMES S. MORTON, PRESIDENT THE GRAHAM & MORTON TRANSPORTATION COMPANY, BENTON HARBOR, MICH.

As is customary on the Great Lakes, the steamships of the Graham & Morton Transportation Company were laid up about the middle of December and will remain out of business until some time in March. The business of the company last fall from October 15 until the close of navigation was good, and, judging from that and the general revival of manufacturing industries reported from nearly all sources, there is every indication that the 1916 freight business of the company will at least start off in a satisfactory manner.

As much cannot be said, however, of the passenger business of the company, which has always been heavy during the summer months, as recent legislation is going to have a very serious effect on the Lake excursion business. There must be modifications of some description of the La Follette seaman's bill to enable the Lake passenger excursion business—especially on short routes—to be maintained as in the past.

We would recommend that the great fresh water lakes be divorced from all salt water or sea-going requirements, as in a general way their interests are not at all alike. The construction of the vessels is entirely different, the routes are short and the runs of the different steamers are generally of a few hours' duration instead of several days.

PROMISING OUTLOOK FOR SHIPBUILDERS AND SHIPOWNERS

CHARLES C. WEST, GENERAL MANAGER MANITOWOC SHIPBUILDING & DRY DOCK COMPANY

There is no question but what present conditions in the shipbuilding industry are very favorable and the outlook for continuance of these conditions is promising. I can only say that I believe our commercial independence depends upon an adequate merchant marine. It should be built on a sound basis, capable of a steady and healthy growth, so that it will fully meet the needs of the country's foreign trade.

FAVORABLE CONDITIONS IN MARINE FIELD LIKELY TO CONTINUE

EADS JOHNSON, NAVAL ARCHITECT, NEW YORK

As to present conditions of business in the marine field, it seems unnecessary to add to the many evidences we have in the unprecedented volume of business at present being handled by all our shipyards and it is my firm belief that this condition will continue for some years to come.

The future is assured, for it seems to me that with the

present growth of shipbuilding in this country, in spite of the serious legislative obstacles such as our navigation laws and the short sighted policy of our government, we *will* have a merchant marine as long as we are financially able to support it. With so many alien interests attracted to the necessity of floating property, it is doubtful if we shall ever go back to the financial hardships of the past.

The only form of legislation that can be recommended at the present time for the continued upbuilding of our merchant marine is that which the present administration has applied to Mexico—"watchful waiting." There are so many obsolete laws that must be redrawn and so many new laws that must be made obsolete to meet new conditions brought about by the present increase in our merchant marine that we shall have to wait for these in due course. New blood is needed in every department directing the government policy towards shipbuilders and shipowners and the people will have it.

It is my hope that the change will be made soon after the next Presidential election.

SHIPBUILDING ON THE GREAT LAKES NOW AT HIGH TIDE

HARVEY C. BEESON, CHICAGO

Shipbuilding on the Great Lakes is now at high tide and all steamship owners are more than optimistic as regards next season's business.

Personally I have no hesitation in prognosticating a movement of iron ore on the Great Lakes for the season of 1916 of 57,000,000 tons. In the past 25 years I have never missed on this estimate, with the exception of one year, and have generally set the amount below the total tonnage reached. The basis of this estimate, therefore, is reasonably sound.

Furthermore, in relation to lake freight rates on coal, grain and lumber for 1916, it is safe to say that they cannot be otherwise than high as compared with any rates paid to date, for the simple reason that the volume of freight to move in these commodities will be increased and the facilities for moving them have steadily decreased.

The anxiety to move ore will keep out considerable tonnage that formerly carried coal. Even the older class of wooden bottoms on the Great Lakes will be good property before the season opens.

AMERICAN TRADE MUST BE CARRIED IN AMERICAN BOTTOMS

J. MURRAY WATTS, NAVAL ARCHITECT AND MARINE ENGINEER, PHILADELPHIA

Every patriotic American must question the policy that has allowed this country to become dependent on foreign shipowners to carry her overseas commerce. The present condition of business in the marine field is an abnormal one, caused by the scarcity of ships available for our growing export trade.

For the last ten years we have been constantly preaching the cause of the American merchant marine, claiming that American trade must be carried in American bottoms. Our experience has shown that trade follows the flag. Take Central and South America. These countries have been supplied largely by German vessels, with German consuls to look after their country's interests, and German banks to make the necessary credit arrangements on the spot.

This firm has designed many yachts and commercial vessels for these countries and often our business arrangements are carried on through Berlin or London, and machinery and equipment sent over to Europe and back across to South America, as we had no ships to make prompt delivery direct from this country.

Naturally South Americans prefer to deal with a country when they can see the visible power of that nation in the flags flying from the fine ships, with a magnificent export trade system behind these ships, like Germany. Up to the last year the average business man took less than no interest in the American merchant marine. The general reply to any appeal to interest them in it was that if the foreign ships could carry our products cheaper than our ships could there was no necessity of having American ships.

When it was explained to them that England, France, Germany and Japan had built up their merchant shipping by subsidies and protective legislation, there was generally a howl that this country should not pay subsidies to enrich one class, namely, the shipping men. This cry came especially from the Middle West, where the people were selfishly against any monetary aid for the coast States. They did not realize that any help to commerce benefited them, whether it was on land or sea.

They forgot that the trans-continental railroads were subsidized enormously by land grants and monetary aid amounting to millions, direct from the government. No one has grudged this aid to carriers on land, as it has been of enormous help in building up the prosperity of the country, but shortsightedly and selfishly they refuse to consider a far smaller subsidy to American sea carriers, not realizing that it would benefit the whole country to an almost greater extent.

Congress since the Civil War has apparently done its best to legislate the American merchant marine out of existence, and the result is that we have practically no American deep sea ships, and the farmers and mine owners cannot deliver the grain, cotton, coal and manufactured goods of which they have an enormous surplus, and for which there is a constantly increasing demand. The very few ships that we have available in spite of this policy of ignorance and prejudice have greatly increased their rates, but even so the demand for tonnage space far outruns the supply.

Besides the ignorance displayed on marine subjects, the coastwise trade has had to struggle against the power of the railroads, who have done all they could to stifle competition, using their dock and terminal facilities to force acceptance of their terms, and getting control of competing canals and steamship lines, and not hesitating to influence legislatures to attain their ends. The revelations in the cases of the Rock Island and New York, New Haven & Hartford Railroads show what railroad management can be.

The case of the Panama Canal tolls is fresh in our memory. The government was pledged to give our coastwise shipping freedom from tolls. This did not suit the great trans-continental railroads, and their influence and that of the Canadian roads were sufficiently great in the lobbies of Washington to have the law repealed and a sufficiently high toll placed on our shipping to keep us from building many ships for this trade, and so seriously competing with these roads.

The latest blow to our shipping is the La Follette bill, jammed through Congress by those truckling to the labor

vote. This bill conflicts with our treaties with all the foreign maritime countries, has destroyed discipline on our ships by encouraging desertion of sailors, and is so palpably foolish that now it has driven our ships off the Pacific. It is no longer being rigidly enforced against foreign ships.

It has, however, been in operation long enough to allow the heavily subsidized Japanese lines to capture all our Far Eastern trade, with the result that our exporters are suffering heavily from arbitrary rates imposed by Japanese shipping owners on all but Japanese goods.

While during the war and for a short time afterwards our ships and shipyards will be busy, the foreign commercial fleets will soon again be competing with us, and our American merchant marine will again fall into innocuous desuetude, as foreigners can build and man ships cheaper than we can, and besides in many cases their ships are subdsidized and given special advantages by their governments.

In the famous cruise of our sixteen battleships around the world we had to rely on English, German and Japanese ships to carry our coal and supplies. In the possibility of our being embroiled in a sudden war we have practically no ships to act as auxiliaries, and no seamen trained on American deep-sea ships to man the auxiliaries, if we could get them.

The American people will learn by experience that their country as a whole needs an American merchant marine in foreign trade. There must be American-built ships, so that at all times our shipyards may be in shape to build and repair ships. The more ships we build, the cheaper they will become in spite of our high cost of labor, and we will develop yards like that of Harland & Wolff, who have standardized their output, so their ships are manufactured like stock motor trucks, all the ships being practically of the same type with identical fittings, and varying only in load-carrying ability. It is important that the actual carriage of imports and exports should be under our own flag, so that the nation shall have a well-organized merchant marine of its own, instead of relying on an unstable supply of foreign ships.

Our early shipping policy inaugurated by Washington and continued up to the time of the Civil War was to encourage shipowners and builders. Since that time, owing largely to ignorant legislation, protection was given to all industries except the shipping industry. That industry, alone and unprotected, with laws making it far more expensive to run our ships than foreign ships, has naturally succumbed, so that now instead of carrying 80 percent of our foreign trade it carries less than 10 percent.

At this time we are paying at least $50,000,000 a year to foreign shipping lines to carry our passengers and goods. To regain our former prestige and build up our deep sea merchant marine, the government should make up to citizens of this country who are willing to invest in shipping the difference between the cost of building and running our own and foreign ships, not to benefit a class of shipowners, but for the benefit of the whole country's trade in time of peace, and her safety in war.

To get a merchant marine we must first get all such senseless and obstructive laws as the La Follette bill repealed, grant subsidies to our ships, and also allow on cargoes carried by them reductions in import duties and tonnage taxes, provided that such reductions will not interfere with commercial treaties with foreign nations.

AMERICAN SHIPYARDS FILLED WITH WORK AT TOP PRICES

G. W. DICKIE, SAN FRANCISCO, VICE-PRESIDENT SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS

If, two years ago, any one had predicted the actual conditions that prevail to-day in the overseas carrying trades of the world, few would have given any credence to his prophecy, yet in fact, in a general way, those of us who for the past twenty years have been trying to make the people of this country realize the effect that a European war would have on our foreign carrying trade have been through all these years predicting the very conditions that now prevail.

As a direct consequence of the general indifference to foreign trade this country now finds itself in no condition to profit by the withdrawal of a considerable part of European shipping from the regular lines of commerce. About a year ago the pinch in shipping facilities began to be felt; shipping houses began to look to United States shipyards for help and those who got their orders placed first have been able to choose between selling ships under construction at a handsome profit or retaining their ownership and operating at very remunerative freight rates. Now all our shipyards are full of work at better prices than they ever had before and have orders booked for two years ahead, yet the need for ships is more urgent than ever.

This condition, which in American shipbuilding is very abnormal, is due to the fact that shipbuilding for mercantile purposes is practically stopped in Great Britain, France and Germany, where the machines and operatives are put to more directly offensive and defensive uses. Mr. Balfour stated in Parliament recently that in order to encourage an industry which had practically almost ceased since the beginning of the war, namely, the building of merchant ships, a clause was put in the munitions bill which would enable them to say that shipbuilding of this kind was carried on as war work, and war work he believed it was. He hoped that the House would let that bill through, as every day that passed meant a day's delay in the completion of some merchant ship. Whether this helps or not, the present dearth of ships will continue until the cessation of war diverts tonnage there used auxiliary to various hostile operations to the peaceful pursuits of ordinary times. Until that time comes the American shipbuilder will have all the work his yard can turn out at prices that should yield handsome profits.

Beyond that the future of shipbuilding in this country will depend upon the chance of securing favorable legislation where that can do any good towards enabling our shipbuilders to hold permanently to the business they have secured under and on account of conditions not of their own making. When the present abnormal condition is removed by the return to legitimate trade of diverted tonnage, our shipowners will seek tonnage where it can be had cheapest. Part of any preparedness programme must be the establishment of a merchant marine built, owned, and operated by citizens of the United States. It does not so much matter who owns the ships so long as they are built here and operated under the United States' flag ready for service when the defense of the country requires their aid. Heretofore, measures which have come before Congress have not been treated according to their merits nor have they been discussed fairly. The questions involved are not of a nature readily understood by the average orator.

Representative Curry now has a bill in the hands of the

committee on merchant marine and fisheries. This bill, should it become law, would lay the foundation for real constructive legislation. If the commission it proposes to bring into existence were composed of the right kind of men representing all the interests connected with the merchant marine, it would become the source of all legislation dealing with that important branch of government and would establish a steadily growing merchant marine in a reasonable time. It would be the duty of the commission to prepare and present to Congress the measures necessary to produce the desired result. Such legislation would naturally grow out of the work of the commission. The object of the legislation and other work of the commission advocated by the Curry bill would be to place the American ship on an equality with the ships of other nations engaged in the same trade. The commission would need the confidence of the Government in all its branches and should be fully backed up by the determination of the people to have a standing on the sea equal to their power and influence on the land.

NECESSITY OF DEVELOPING THE STATE NAUTICAL SCHOOL

COMMODORE J. W. MILLER, CHAIRMAN BOARD OF GOVERNORS, NEW YORK STATE NAUTICAL SCHOOL

For the past thirty-eight years, during which there has been a general apathy regarding the development of marine commerce, New York has continuously maintained an institution of high standard for the education and training of officers for merchant vessels. For this purpose a ship, together with officers of high intelligence, has been provided by the Navy Department.

Prior to 1913, the city of New York, under its Board of Education, met all other expenses. Since that date the schoolship has come under the direct jurisdiction of the State of New York, and to-day the young men of the lake region as well as those from the Atlantic coast are seeking admission in large numbers. The schoolship *Newport*, at present provided by the Navy Department, is too small to receive the many applicants who now apply.

Realizing the present critical condition, when the whole country is alive to the necessity of an increase in our merchant marine, and when officers must be supplied at an early date for such a development, the Board of Governors has been in negotiation with the Navy Department for a larger vessel, but has been advised that none is available. To secure such a vessel would require the expenditure of about $100,000 (£20,500). On March 4, 1911, Congress passed a statute carrying a proviso for an appropriation of $25,000 (£5,125) per annum for each State supporting a nautical school, but since its passage no appropriation has been made to the two States (Massachusetts and New York) having such schoolships. The total amount, if it had been allowed to date, would have been $200,000 (£41,000). In view of this it seems that steps should be taken by all interested in sea power to procure an appropriation from Congress of at least $100,000 (£20,500) for the State of New York to purchase, if necessary, a ship to replace the *Newport*. If deemed wise, the authority for such purchase could be vested in the Secretary of the Navy, with the understanding that the vessel would be turned over to New York, but liable, of course, to be taken up by the Navy Department in case of a war crisis.

If the American merchant marine is to be rehabilitated, we must have trained American officers and seamen to man the ships. It would seem, therefore, only necessary to state the fact that at a cost of $100,000 (£20,500) the State of New York alone could graduate each year about one hundred men thoroughly equipped to perform their duties on board an increased merchant fleet. No further argument ought to be needed on this subject, especially at a time when stalwart young men, full of the old American sea spirit, are ready to follow the sea if the chance only be given them.

DEVELOPMENT OF A NATIONAL SHIPPING POLICY

ROBERT DOLLAR, PRESIDENT THE ROBERT DOLLAR COMPANY, SAN FRANCISCO

In a paper presented before the third National Foreign Trade Convention at New Orleans, La., on January 27-29, Captain Robert Dollar, president of the Robert Dollar Company, had the following to say regarding the American merchant marine:

Various remedies have been proposed for the solution of our merchant marine question. The proposals now figuring most prominently before the public may be summed up under three heads: First, Government ownership; second, equalization of operating cost, under whatever name may be given to the direct assistance of the State to shipping; third, the development of a truly national shipping policy along lines recommended by a permanent nonpartisan shipping board after business-like consideration of the country's real shipping necessities.

Government ownership is a proposition to pay a subsidy of far greater scope than any subsidy policy that has as yet been proposed; for any subsidy contract is necessarily limited as to the amount of money which may be disbursed to the shipowners undertaking the subsidized services, whereas, with the Government itself operating the ships on that extravagant scale with which all business men are familiar, there is no limit to the deficit that may be accumulated by the ships performing the services yet to be announced.

This much, however, can be said: The Government proposes to embark in a business which normally costs 25 to 35 percent more to conduct under the American than under foreign flags. Unless the Government can perform the service more cheaply than private enterprises, it must incur deficits to be met out of the public treasury. The vessels cannot be leased to private companies unless private companies can operate them profitably.

In other words, the only way the Government can induce private companies to operate those ships under the American flag, under the conditions prevailing before the war, and which surely will prevail after the war, is to make the leasing price low enough to offset the excess of operating cost over that of our competitors. Somebody must pay, and under the Government ownership principle it will be the taxpayer. The increase of our shipping in foreign trade will depend upon the willingness of the taxpayers to increase the appropriations to be made for the new construction, and, possibly, continued deficits in the Governmental shipping policy account. In other words, the shipping policy, requiring continuing and increasing

appropriations, will be under debate at each session of Congress. It is easy to see how sectional and political considerations may complicate any shipping progress dependent upon the Government ownership policy.

What better means could be found of ascertaining the needs of our shipping in the matter of cost equalization than through the establishment of a non-partisan Shipping Board, composed of practical men who thoroughly understand the shipping business, that would undertake an unbiased study of the question, Congress, in the meantime, refraining from increasing its legislative labors on the subject of shipping until it could be guided by the findings of such a Board.

The National Foreign Trade Council, in its report on the merchant marine question, adopted at the meeting held in New York, on September 23, 1915, advocated the establishment of a permanent Shipping Board composed of five members experienced in shipping and foreign trade, which would recommend to Congress such revision and modernization of all United States laws relating to shipping as might be deemed necessary, while permanently discharging all the functions of the Federal Government relating thereto. What better guide to the education of public opinion along rational channels in shipping matters could be constituted than by means of such a shipping board as was proposed by the National Foreign Trade Council?

If we desire to elevate American shipping to the dignity to which it is entitled by reason of our enormous foreign trade, our national wealth and the extent of our coasts and possessions, let us consider the problem in a manner worthy of its importance, so as to lay the foundation of an evolution that may bring us in line with all those nations that since the remotest days of antiquity have placed their utmost ambition in the possession of the reins to the car of Neptune.

FACTS CONCERNING THE SEAMEN'S ACT

H. H. RAYMOND, PRESIDENT MALLORY STEAMSHIP COMPANY, NEW YORK

The La Follette seamen's act is one of the most radical pieces of legislation that has been enacted by the United States Congress in many years.

Section 1, providing that on all merchant vessels of the United States of more than 100 gross tons, except those navigating rivers, harbors, bays or sounds exclusively, the deckhands must, while at sea, be divided into at least two, and the firemen, oilers and water tenders into at least three watches, which shall be kept on duty successively, merely makes statutory what has been customary, except that on short runs on the Great Lakes and elsewhere where the practice has not been pursued, a change is made obligatory. The act does not discriminate in this matter between a voyage to Bombay or Australia and a trip outside the Hudson River to the fishing banks or on one of the short daylight excursion routes, where such a distribution of the hours of labor will necessitate the doubling of the deck crews and the trebling of the engine room forces. It will also be particularly expensive on vessels making landings at small ports in sparsely settled communities along the Pacific coast.

Section 10, prescribing regulations for life-saving equipment and structural modifications of ships, and providing for certified lifeboatmen, has been taken almost bodily from the recommendations of the London Conference on Safety of Life at Sea, which, had not the war intervened, would doubtless have been adopted by all maritime nations. These are admirable for the ships for which they were intended, viz., trans-oceanic craft. By the terms of this act, however, they have been made applicable, with but slight modifications, to the whole of the shipping of the United States, including the coastwise, bay, sound and Great Lakes shipping. This will necessitate extensive alterations not contemplated when those vessels were designed and constructed, and their structural stability may be seriously affected.

Section 15 compels the owner of every vessel of the United States and every owner of a foreign vessel while in the ports of the United States to pay to the seamen on demand one-half of the wages due them at every port, providing this demand is not made before the expiration of nor oftener than once in five days. Is it reasonable to expect that foreign nations will meekly consent that agreements made with the seamen in their own country shall be nullified as soon as their ships reach an American port?

Section 16, providing that 75 percent of the crew, in each department of every American ship, and of every foreign ship coming to an American port, must be able to understand any order given by the officers, has had the effect of eliminating six large American ships from competing with the existing Japanese steamers on the trans-Pacific trade. These vessels carried American officers on the deck and in the engine room, but their crews were Chinese. It was by this means alone that they were able to sustain their trans-Pacific service for so many years. The petty officers among the crews were bi-lingual and able without difficulty to communicate to the crews the orders given by the American officers. To insist that 75 percent of a Chinese crew shall speak English sounds the end of the American ship as a competitor in the trans-Pacific trades. Any expectation that this requirement will lead to the creation of a large body of American seamen speaking the language of the officers of the American ships is absurd. Furthermore, experience has not proven that this requirement will be conducive to the safety of life at sea.

Section 17 provides that every American vessel and every foreign vessel clearing from an American port must carry 65 percent able seamen. The requirements for qualification for an able seaman's certificate are three years' service on deck at sea for ocean service and eighteen months' service on the Great Lakes, except that where an applicant can pass an extra examination one year's service will suffice, provided such one-year men shall not form more than 25 percent of the 65 percent able seamen. The term able seaman belongs to the days of the sailing ship. The work performed by the deckhands aboard a modern steamer is of the most ordinary kind of unskilled labor. To insist that it requires three years' experience to acquire facility to perform such simple duties is farcical, the general opinion of practical steamship men being that as many months at most is amply sufficient. The sole effect of this provision of the act will be to restrict the number of men available for this kind of work, which no legislation should seek to accomplish. This provision of the act was considered by the International Conference on Safety of Life at Sea and was almost unanimously rejected, the conference considering that their recommendations providing for safety appliances and certified lifeboatmen were amply sufficient for this purpose and that it was ridiculous that a deckhand should have an additional certificate as an able seaman.

An Analysis of the Shipping Bill

Salient Features of the Administration Measure for Upbuilding the American Merchant Marine

By "Old Scotch"

It will be taken for granted, I think, that there is no argument but that the United States needs a vast increase in its own shipping for the foreign trade. We can not continue long to deliver our manufactured products in the delivery ships of our principal competitors for the world's trade. We will, of course, continue to sell those of our articles of export where little, if any, real competition exists. These non-competitive articles, such as wheat, petroleum, cotton, etc., are drawing largely on our natural resources, and, while furnishing work for our farmers, produce but little business for the vast army of our citizens employed in manufacturing. The development of our foreign trade in manufactured articles is of primary importance; the merchant marine which we need is but contributory.

Federal Aid Needed for the Merchant Marine

It is now generally recognized that to build up our merchant marine, some help is necessary from the federal government. We must not lull ourselves with the belief that the temporary activity in our shipyards marks the dawn of the much dreamed of restoration of our foreign shipping. Far from it. If we take discerning notice of the ships now building we will find that, aside from new coastwise steamers, a great number of tankers and a respectable showing of ships for foreign buyers, there are but few now on the stocks for the foreign trade.

The bill now pending before the House of Reprensentatives represents in its entirety more constructive and beneficial legislation in the making than has ever yet been proposed towards the much desired revival of our foreign shipping. To those interested in the subject I would say, do not too hastily form conclusions concerning this measure. The much-heralded bugaboos of Government ownership and Government competition with private interests become very remote when the true intent and meaning of this bill is analyzed. The three most important features of the measure are the formation of a Shipping Board to have general supervision over maritime matters; the creation of a fleet of naval auxiliaries and army transports, and the utilization of the fleet thus created in the extension of our foreign commerce in peaceful times. Looking at these objectives more closely we find the following:

The Shipping Board

The Shipping Board is to be composed of five members, two of whom are to be the Secretary of the Navy and the Secretary of Commerce, ex-officio; the other three members are to be practical shipping men, thoroughly conversant with ships and maritime commerce, one of whom is to be designated as chairman by the President. The salary of each of the three practical men is to be $10,000 (£2,050) per annum, and it is provided that they can engage in no other occupation, thus being able to devote their entire time to the Shipping Board. With certain exceptions, all the employees of the Board are to be taken from the civil service lists. Primarily the Board is authorized to construct in American shipyards and navy yards, or to purchase or charter vessels of a type, as far as the commercial requirements of the marine trade of the United States will permit, suitable for use as naval auxiliaries and army transports. For this purpose the proceeds of the sale of $50,000,000 (£1,025,000) of Panama Canal bonds is placed at the disposal of the Board.

Naval Auxiliary Fleet

In ordinary times this amount of money in American shipyards will produce a fleet of vessels of approximately 500,000 gross tonnage. The Chief of Operations of the United States Navy states that that amount of shipping of this kind is absolutely essential to place the navy in a state of preparedness. All persons familiar with shipping will remember the humiliation we were subjected to when our fleet of battleships made its celebrated passage around the world by being compelled to charter foreign colliers to supply the fleet with the necessary fuel and provisions. Such auxiliaries are as important to success in naval operations as the fighting ships themselves.

In times of peace, however, but a small portion of such auxiliaries are necessary for the operations of the navy, and under ordinary conditions the greater part of such a fleet would be tied up in idleness at the navy yards and become a constant source of expense for deterioration and care taking. What more logical use therefore could be made of such a fleet than to charter these vessels to shipping men for the building up and extension of our foreign trade? The question which will naturally be propounded by prospective charterers will be as to how they can be operated in competition with foreign vessels. Just here is where the government help will be apparent. We all know that the principal items of operation are interest on capital invested, wages and food of crew and the cost of fuel.

Savings on the Investment

Let us look on these three principal costs with an analytical eye! We will find that the government with its credit back of it has borrowed the money to construct the ships at about three percent per annum; private interests would be extremely fortunate to borrow money for similar purposes at six percent. Depreciation plays no favorites, and would be the same for all ships, government-owned or otherwise. There would, therefore, be—as the government will not be in the shipping business for a profit—a differential of three percent in overhead charges on these leased ships immediately apparent. Fifteen thousand dollars (£3,080) annual saving on a five hundred thousand dollar (£102,500) ship would be no inconsiderable item in the balance sheet of a shipping firm.

It is almost needless to remind shipping men of the great economies to be gained in operating a fleet of modern vessels, equipped with the latest types of marine propulsion, in competition with the average of all ships built in the last twenty or twenty-five years. Those are the ones with which the American fleet will have to compete. Our foreign rivals are handicapped with this old equipment, and there is but little danger, owing to their value, of a wholesale consignment of these vessels to the scrap heap. We will have a decided advantage with the proposed new fleet for a number of years, as we can thus capitalize our delinquencies in shipbuilding heretofore into a decided asset. It is needless for me to remind marine men that the

average saving on fuel with the modern type of geared turbines over the average reciprocating engine afloat today is as high as thirty percent, and with certain internal combustion engines even greater than that. The use of oil fuel, of which this country controls two-thirds of the world's output, opens up another avenue of saving; when carried in hitherto unused double bottoms it adds from five to ten percent to the freight earning space. It requires but little calculation to prove to your own satisfaction that the combined savings due to cheap capital, reduction in consumption of fuel and added freight space will easily offset the cost of increased wages and better food incident to American ship operation.

Creation of a Naval Reserve

In order to create a naval reserve with which to man these auxiliaries and to act as a feeder to the regular navy, the bill provides that all officers and men serving on the ships thus created, who are American citizens, may be enrolled as members of the reserve, and as a retainer for thus holding their services in readiness for this country's demands in war times, they are to receive compensation which will amount practically to one month's full wages for a year's enrollment. In this way alone it is possible to overcome at least ten percent of the differential between American and foreign wage rates—a decidedly favorable item in the cost of operating these naval auxiliaries by private management.

Not alone are the new ships created by the proposed act to be placed under the Shipping Board, for the bill further provides that all the existing naval auxiliaries, army transports and Panama railroad ships which can be spared are to be placed under the Board's control and leased to the best advantage. In these days of freight embargoes by the railroads, on account of lack of ships, enormous freight rates and congested conditions generally, the immediate leasing of government ships with a combined freight capacity of sixty to eighty thousand tons would be no small boon to our exporters.

Government Ownership a Last Resort

The twin bugaboos of government ownership and operation will be found to dwindle down to a section of the pending bill which provides that the Shipping Board, if in its judgment it becomes necessary to do so, may form a corporation or corporations and purchase not less than the majority of the stock thereof, to operate and maintain a fleet of vessels in the commerce of the United States. This procedure would not, it is but fair to assume, be resorted to, unless no private concern would charter the vessels or otherwise provide efficient means of transportation on certain routes where the commercial interests of the country demanded that such be provided.

Much business has been in the past lost to the United States because our manufacturers, in competition with foreign rivals, have been unable, owing to the existing restrictive laws, to guarantee quick deliveries. For example, if a railroad in the Argentine should be in the market for a large consignment of steel rails, and invited tenders from firms in England, Germany and the United States, and stipulated that quickness of delivery would be an important factor in the award of the contract, while the American bidders might be able to roll the order as expeditiously as their foreign rivals, they would not be allowed under existing laws to arrange with the railroad to the sea coast to have the delivery made at the port of departure for a specific sailing of the vessel chartered to deliver the rails. The shipment by rail would have to take its regular turn with the shipment of all other classes of freight, the delivery of which is always problematical. Again, if the competition in price of the rails was very close the railroads would not be allowed to depart from their scheduled rates for all shipments of that particular class of freight. The German competitor could secure specific sailings for his cargo, and when necessary to win out in the competition the railroads to the sea could aid in securing the order by reducing the usual freight charge. The pending bill provides expressly that both specific sailings and preferential rates may be offered by the railroads whenever such procedures are necessary in order to secure foreign orders for goods of American manufacture. The value of such concessions should not be underestimated when the shipping bill is considered.

Licenses to be Required for all Vessels Entering American Ports

The Shipping Board will have control to a large extent of the rates to be charged in all water borne interstate and foreign traffic. It might be asked how this control will extend to foreign vessels. While of course there can be no direct jurisdiction over vessels of other countries engaged in our foreign trade, it is provided that all vessels, both domestic and foreign, must first obtain licenses from the Shipping Board before they will be allowed to enter and clear from our ports. The Board is empowered to establish such rules and regulations as in its judgment may be necessary, and no corporation, firm or individual will be granted a license unless they agree to abide by these rules and regulations. One need not stretch his imagination very far to conceive that these rules will prohibit unfair competition by rate cutting, or that the so-called foreign "fighting ships" will not be allowed to compete with our own vessels.

Owing to the disturbed conditions abroad, a considerable fleet of foreign vessels, the majority of whose stock was owned by American citizens, took refuge under our flag, owing to certain concessions made in our navigation laws by Congress. Should this bill pass none of these vessels, and no other vessel now flying the American flag will be allowed to be transferred to any foreign registry without the approval and consent of the Shipping Board. During our Civil War many of our merchant vessels passed to foreign registry for protection on the seas and were never allowed to come back. This clause of the pending bill will, in a manner, compensate for some of the losses of our tonnage at that time, and, furthermore, be in conformity to the prevailing practice of our leading foreign rivals.

American Ships Available for Naval or Military Purposes

All vessels leased, chartered or sold by the Shipping Board must, under the terms of the bill, be held in readiness to be taken over by the United States, absolutely or temporarily, for naval or military purposes, should the occasion arise to make such procedure desirable on the part of the Government. The consideration must be the fair actual value if purchased outright, or a reasonable rental, based upon normal conditions, if taken but temporarily. This will prevent a repetition of the "gouging" to which our Government was subjected at the outbreak of the Spanish-American War.

There need be no fear of any unusual international complications if any of the vessels leased by the Government, or owned wholly or in part by the United States and operated in strictly commercial business, should be seized or hindered by belligerent nations, as it is expressly provided in the bill that all such vessels shall in all respects be subject to all laws, regulations and liabilities governing merchant vessels.

It is also expressly provided that only such of the vessels controlled by the Shipping Board as may have been constructed in the United States can be used in the coastwise trade, and particularly the trade between the Atlantic, Gulf and Pacific Coasts.

Much complaint is heard concerning our existing navigation laws; to their alleged improprieties and shortcomings are attributed many of our shipping ills. No board now exists to investigate them in a broad-gaged manner. This bill especially empowers the Shipping Board to make diligent investigation into the navigation laws of the United States, and to furnish the President with such information and data as will enable him to recommend to Congress what remedial legislation may be necessary for the promotion and development of the American merchant marine.

Thus we have the much talked of Shipping Bill in all its phases. Consider it from any angle you may, it presents the most feasible and comprehensive plan yet devised to accomplish the purposes for which it is intended. We are at the threshold of a grand rearrangement of the world's business, and particularly of the business of sea transportation. England, France, Germany and Japan own over three-fourths of the world's shipping; in each of these great nations its merchant marine is now under governmental supervision. The time for the United States to act is now. No longer must we sit supinely by, some arguing for the impossible—the attainment of direct subsidies—others contending for this scheme and that scheme, and all bemoaning the fact that we have so few vessels with which to develop our foreign trade. We have almost within our grasp a clear-cut, definite and beneficial policy for our maritime development. If we do not embrace this opportunity, what have we then to contemplate?

The writer has spent many years in the study of merchant marine conditions; he has had unusual opportunities to observe at close range the tendencies of legislative matters at the national capital; he early embraced and tenaciously clung to the doctrine of direct subsidies until he saw the chances for such legislation pass into oblivion; he is writing these views solely from the standpoint of patriotic Americanism, as he has no other interest in the matter. In conclusion he predicts that, unless this measure is passed substantially as it is drawn, and at this session, there are but small hopes for helpful merchant marine legislation for many years to come.

A New and Constructive Policy for Upbuilding the American Merchant Marine

Formation of Federal Shipping Board the First Step—Expansion of Foreign Commerce—Provision for Naval Auxiliaries

BY BERNARD N. BAKER
Former President of the Atlantic Transport Company

Little or no difference of opinion exists among the people of the United States on the general proposition of restoring our flag to the seas. It is freely granted that the differences as to how this may be achieved are wide and apparently irreconcilable, but upon the broad question of whether we should or should not have a merchant marine we are in perfect accord. It is true that there is a group of men who honestly doubt if our shipping can be re-created without direct subsidies; another group that holds to the theory that all navigation laws must be overhauled if our shipping is to prosper, and still another group that insists that government ownership and operation of ships is the only means whereby ultimate maritime success can be achieved.

There would appear, offhand, to be no common ground upon which these men might stand. They are undoubtedly far apart in their views, and it might seem to be an impossible task to reconcile convictions so divergent, to offer a merchant marine program which would embody the best thought of all conflicting elements. Such a plan, however, is not impossible. On the contrary, it is decidedly possible.

Creation of a Shipping Board the First Consideration

There is, under existing circumstances, but one defensible method of dealing with all the questions involved in the establishment of a merchant marine under the American flag. This centers about the creation of a Shipping Board, endowed with powers sweeping enough to meet every issue, and with money enough at its disposal to carry into effect any policy which it may find necessary to adopt. The establishment of such a Board is an imperative necessity and should be the first consideration of Congress, when that body approaches our marine problem. All other questions may be subordinated to it or, rather, may be merged with it.

Commission Regulation Not an Untried Experiment

If sufficient authority is given a Shipping Board, it may be relied upon to go to the very root of our difficulties, to study the demands of our commerce and the needs of our navy, to weigh the claims of our labor, and, resolving the results into a concrete whole, to give the country an effective administration of our over-seas shipping industry. There is no other feasible way in which the government can, in the present circumstances, render assistance to this interest. The work should be done by an expert body of men enjoying the confidence of business and labor in equal measure, and entrusted with the power to move in the direction which will best serve the national interests.

Nor is the commission plan of handling special phases of the government work a new idea. It is not an untried experiment. We have made use of these bodies for more than twenty years, and have delegated more and more power to them as each successive Board has demonstrated its usefulness. Only an arrant iconoclast would dare propose the abolishment of the Interstate Commerce Commission, the Civil Service Commission or the Federal Reserve Board. Each of these bodies has a fixed place in our system of government, and long ago each of them vindicated the judgment of its creators. The proposal for a Shipping Commission is but another step in the

same general direction, another move toward competency in handling a definite piece of work demanding the skill and experience of specialists.

Such a Board as is here suggested should devote itself primarily to the expansion of our commerce through the establishment of steamship lines and to the equipment of our army and navy with shipping auxiliaries by the purchase or construction of a fleet of merchantmen. All else might be properly regarded as detail. The means which the Board would employ to this end, the adjustment of labor controversies, the kind of ships and the number of ships to be acquired, the financial plans and the matters of mere organization, could be worked out under the blanket authority given.

Personnel of the Shipping Board

This Board should be composed of five men. The Secretary of the Navy should be an ex-officio member, by reason of his direct interest in a naval auxiliary and a naval reserve. The Secretary of Commerce, by reason of his direct interest in our foreign trade, should likewise be an ex-officio member. The three remaining members should be known as Commissioners, and should be shipping experts. They should be appointed by the President, by and with the consent of the Senate. One of the Commissioners should be designated by the President as the Chairman of the Board, and a second should be designated as the Vice-Chairman. No Commissioner should be actively engaged in any other business during his service on this Board.

The Shipping Board, as proposed, should be given authority to construct, in American shipyards, if possible, or elsewhere, if necessary, or even to purchase in the open market, a fleet of merchant vessels. These ships should be of such type and tonnage as will make them suitable for naval auxiliaries or army transports. This is the primary consideration. These vessels would, naturally, be avaliable for the merchant trade, but at all events should be so constructed and equipped as to make them of immediate use to our naval and military establishments.

Powers of the Shipping Board

Once the vessels have been acquired, either by construction or by purchase, the Shipping Board should be empowered to charter, lease or sell them to such corporations or individuals as will guarantee to use them for the transportation of commerce between the United States and foreign countries, and authority should reside in the Board to operate steamship lines, if such a condition should arise as to make it absolutely necessary. If, however, the ships are chartered, leased or sold to private parties at a low rate of interest, say four percent or less, it is reasonably certain that the emergency power just indicated will never have to be resorted to. This question of interest rates is one of great importance. While the war in Europe is in progress, and perhaps for years after it is over, money for marine investments abroad will necessarily be high. In our movement to organize a merchant fleet we should, therefore, use the credit of the government to the very best advantage.

In turning over government-owned vessels to private interests, a reservation should be made to the effect that no steamship line organized by this means should enter into competition with any existing American company supplying a satisfactory service at reasonable rates. It would be bad policy to interfere in any degree with such service or with any satisfactory service that may hereafter be provided by private American interests. It should not be the purpose of the Shipping Board to drive American enterprise off the seas. Its purpose should be to supplement, not duplicate, the efforts which our citizens may already be directing toward the extension of ocean facilities.

In order to provide a merchant fleet of sufficient proportions to meet our pressing commercial as well as our military needs, the Shipping Board should have at its disposal not less than $50,000,000 (£10,250,000). With this sum from forty to fifty ships, with an aggregate tonnage of approximately 500,000 gross tons, may be acquired. No fewer vessels will meet our present demands. Twice that number could be used to advantage in our trade campaign, and our naval authorities have urged the acquisition of at least this amount of tonnage if our fighting ships are to be even partially supported. The money could be raised without burdening the people with one dollar's direct taxation, by the sale of Panama Canal bonds, already authorized, and now in the Treasury unissued.

Inasmuch as the creation of a Shipping Board and the acquisition of a merchant fleet are predicated upon their value to our army and navy, the vessels in question should be available at any time for military purposes, and Congress should provide the power to take over temporarily or absolutely any or all ships for use as transports or naval auxiliaries at any time they might be needed. A fair rental, based upon the actual value of the vessels requisitioned, should be fixed for the protection of the operating companies and of those who may have invested in them.

Coastwise Shipping Should be Unmolested

Special provision should be made whereby the Shipping Board shall lend all possible assistance to the trade between the Atlantic and Pacific Coasts via the Panama Canal. It is doubtful if all the vessels which the Board may acquire should be permitted to engage in coastwise shipping. A vessel, for instance, that may be purchased abroad at a cheaper price than a vessel of the same type built in the United States, should not be permitted to compete with the domestic ship in the coastwise trade. It would, perhaps, be well to draw the line so as to admit to the coasting business only vessels built in American shipyards, either by the Board itself or by others who have sold or leased ships to the Board.

The President should be authorized to deliver to the Shipping Board any auxiliary vessel now belonging to the army or navy or controlled by the Panama Railroad, if, in his judgment, such vessels are not needed by either of these departments of the government. These ships, upon delivery to the Board, should become immediately available for commercial purposes and should be leased or sold to any interest that would guarantee to operate them on American trade routes. It is well known that the Navy Department now has a number of colliers, for instance, which it might conveniently convert into trade carriers, and to that extent furnish relief to our trade interests. There is no law, however, permitting the Secretary of the Navy or the President to utilize these ships for any other than naval purposes. These colliers, of course, would not be beyond the call of the navy in time of stress. They would have the same status as any other auxiliaries which the Shipping Board might have leased or otherwise disposed of, and could be recalled any time they were needed.

In order to carry out the purposes for which a Shipping Board may be created, that body should have authority to form a corporation, with the right to build, purchase and operate merchant ships to be used in extending the commerce of the country. The Board should have the power to subscribe in the name of the government to the stock of the corporation which it has formed, but should not subscribe to less than a majority of the shares, in order to maintain control of the corporation's affairs.

With the approval of the President, however, the Board should be permitted to sell the government's stock whenever private interests show a willingness to buy it, provided it can be disposed of on terms that are manifestly in the public interest.

Under such a provision as this the government would be engaged in the shipping business only so long as private enterprise held off. If at any time such interests wished to take over the corporation formed by the Shipping Board, they would have the privilege of making an offer to the Board for the government's holdings, and, if the President agreed, these holdings could be disposed of. Even then, however, the vessels owned and operated by the corporation should be available for military or naval emergencies. It would be wise to give railroads the right to buy or lease vessels controlled by the Shipping Board, provided such ships were used in extending the lines of the land carriers under conditions that would extend domestic and foreign trade without stifling competition.

Regulation of Domestic Enterprises

If a Shipping Board is to attain a state of highest usefulness, it must have the power to regulate the operation of all domestic enterprises engaged in shipping between American ports and between this country and foreign ports. This power of supervision should extend to all trade practices, to the determination of transportation routes, and to joint railroad and steamship movements of freight. The Board should even be given a degree of rate-making power. It should have authority, for instance, to prescribe maximum charges to be collected by all domestic corporations engaged in the shipping, and in certain instances should be allowed to fix preferential rates on export shipments when these may be necessary in order to promote trade expansion. It is, however, questionable whether the power to fix minimum rates should be given to the Board. The steamship business is often subjected to such conditions as make it necessary to reduce rates without notice. This would be impossible if the Board had arbitrarily fixed minimum as well as maximum rates.

In giving power to the Shipping Board to fix joint railroad and steamship rates, the authority of the Interstate Commerce Commission over the railroads should not be infringed upon. On the contrary, the latter body should be authorized to confer with the Shipping Commissioners to determine the reasonable proportions of a joint rate. Whatever these two bodies agreed upon should be enforced against the land and water carrier alike.

Revision of Navigation Laws

Another duty of importance should be assigned to the Shipping Board. It should have the power to inquire into all navigation laws of the United States now in effect, and should then determine what laws are unnecessary, oppressive or unduly burdensome either upon our shipping interests, our marine labor or our shipbuilding industry. At the same time the President should be given authority to suspend, upon the recommendation of the Shipping Board, any law or any part of a law which the Executive and the Commissioners may decide is against the best interests of the country. This suspension should be by Executive proclamation, and should remain in effect until Congress has had an opportunity to repeal the law or laws in question. Such a step as this would meet every existing demand for necessary changes in our navigation laws and would put the responsibility for such action upon the shoulders of the commission of experts, representative of all interests involved.

A feeling will no doubt prevail among those who may study the plan as so far outlined, that such a program deals only with domestic corporations or interests engaged in shipping and that the foreigner trading at our ports escapes all the regulations and supervision that it is now proposed to impose upon our domestic enterprises. And if the plan ended here this point would be well made. The plan, however, extends further; and though recognizing the fact that the Government of the United States has no jurisdiction over foreign corporations as such, it includes a license provision which has the same effect as jurisdiction.

Advantages of the License System

For instance, the law creating a Shipping Board should provide that every corporation, firm or individual desiring to trade in American ports must have a license from the United States, to be issued by the Shipping Board, giving vessels the right to enter and leave the ports of this country. Advantages of such a license system are obvious to any one who stops to consider the question. If we provide that a vessel must have a license or permit in order to touch at our ports, we can at the same time fix the conditions under which we will grant the permit. We can enforce our freight-rate regulations, compel the use of certain safety-at-sea equipment, bar unfair practices in competition, and exact obedience to our laws. All this may be accomplished by the simple expedient of giving the Board power to revoke the license of an offending steamship company. Such authority as contemplated is sweeping, yet it is absolutely necessary if we are ever to have even a semblance of control over alien ships that trade at our ports.

The Shipping Board and the merchant fleet which it is proposed to create give us our long-hoped-for opportunity to found a naval reserve. It has already been shown how the merchantmen may become auxiliaries for both the army and navy, and how this may be done without increasing our defense budget. I now propose to show how a reserve for the navy may be established with a comparatively small expenditure of money.

Naval Reservists

The officers and crew of every merchant vessel controlled by the Shipping Board should be given the privilege of volunteering as reservists, and such of these men as qualify, after being examined, might be enrolled as members of the Naval Reserve in various ranks and ratings corresponding to those in the navy itself. All such volunteers must be citizens of the United States, and the regulations for the reserve should be approved by the Secretary of the Navy. The examination for admission to the reserve of officers and men should be held by naval officers designated by the Secretary for that purpose. All reservists received into the corps by this means should receive an allowance from the government in addition to their pay as merchant sailors. This allowance should not exceed $5 (1/0/10) a month for enlisted men, $10 (2/1/8) a month for petty officers, $12 (2/10/0) a month for warrant officers and $15 (3/2/6) a month for commissioned officers.

It cannot be doubted that such an investment in a naval reserve would be mutually beneficial to the navy and to the merchant marine. In the first instance, it would provide a body of from 10,000 to 15,000 trained reservists for the naval establishment, a military asset of which we are badly in need. It would take but little additional training to convert a merchant sailor into a naval sailor, a merchant officer into a competent naval officer. From another point of view, a naval reserve would invite a far more desirable class of young men to the sea than ever before. Instead

of our country boys going to the already overcrowded cities, they would have open to them fine careers in the merchant marine, and be able to hold positions yielding dual pay. From any point of view the naval reserve in our merchant fleet will be worth every dollar it may cost our government and a great deal more.

A report recently made to Secretary McAdoo by Captain-Commandant E. P. Bertholf of the United States Coast Guard shows that a naval reserve of 10,000 men can be maintained by this plan at an annual cost of approximately $600,000 (£123,000), or about as much as the annual cost of keeping in service a single battleship of modern type. What an insignificant sum to pay for this essential feature of naval preparedness!

The Shipping Commissioners

A Shipping Board, however ideally conceived, cannot rise to its full responsibilities unless its members are men of the highest type. They must be of the same relative calibre as those who compose the Federal Reserve Board. They must command the implicit confidence of the country and must have no other interest than that of our merchant marine, our foreign trade expansion and our military preparedness. Such a body as defined in the foregoing will have many important issues to meet. The labor problem will be a difficult one. Our business men will raise question after question, and our shipowners themselves will present perplexing problems for solution. It would seem necessary, therefore, to name as Commissioners men who would in one way or another be familiar with these vital interests. Then, by common counsel and an exchange of ideas, they would be able to administer the affairs over which they had jurisdiction for the general good of all concerned.

It is not impossible that in the course of a few years Congress, after experimenting intelligently with a Shipping Commission, will go a little further and create a Department of Marine. All leading maritime nations have such departments, presided over by a Cabinet Officer or Minister. All of them recognize the inherent value of shipping as a national asset, and give it equal representation with other interests in their systems of government. Before such a consummation is possible, however, the present idea must be tried out and must justify itself by actual service to the country.

Adjustment of Competitive Conditions

It may be fairly expected that with a Shipping Board in authority over our merchant marine, we will be in better position to deal with maritime interests of other nations in harmonizing differences and in adjusting competitive conditions. Conferences should be held to discuss questions affecting all nations alike. Conciliatory proposals would be forthcoming when sharp issues were raised, and co-operation would be possible once European nations found that we have a responsible body with whom they could negotiate and a merchant fleet with which they must reckon. All this will be infinitely easier as a result of the handicaps under which European shipping will labor as a result of the present war.

A Shipping Board, such as here suggested, should make reports annually to Congress embodying recommendations for the further extension of our trade facilities. One of its first duties in this connection should be the preparation of a comprehensive plan for changes in the Ocean Mail Act of 1891, in order to secure additional fast mail, parcel post and passenger lines from our shores to foreign ports. The Board could serve Congress most efficiently in an advisory capacity, and should have the widest latitude not only in the enforcement of existing laws and regulations, but in urging upon Congress the necessity for others.

This program represents a new and constructive policy with respect to our merchant marine. We all know that the policies of the past have failed, that the hopes of our people have been disappointed, and that our foreign commerce has been sacrificed. A new course must be pursued. New remedies must be applied, otherwise we shall stand still as a maritime power while the remainder of the world moves away from us.

A great countryman of ours has said that "the hardest thing to get done is that which everybody admits ought to be done." It is perhaps this fact which has kept us from doing our duty in providing a merchant marine. But, in the name of all that is wise and prudent and patriotic, let us no longer postpone the work. Let us, as good citizens and loyal Americans realize the responsibilities of the future and prepare to meet them!

Shipping Bill Submitted to Congress by New York Chamber of Commerce

A shipping bill for encouraging the building and operating of merchant steamers in foreign trade under the American flag, compiled by a committee of twenty-five members of the Chamber of Commerce of the State of New York, was introduced in Congress on February 19. The bill is offered as a practical substitute for the pending Administration shipping bill, and involves four special features: First, the creation of a Federal shipping board; second, the reduction by the Postmaster-General at his discretion of the speed limits for mail ships in foreign trades; third, the payment by the Government to American shipbuilders of sums sufficient to make up the difference in cost of building American and foreign ships; and fourth, the payments by the Government to American shipowners of sums sufficient to make up the difference in cost of operating American and foreign ships.

The Merchant Shipping Board proposed consists of seven members, including the Secretary of the Navy and the Secretary of Commerce and five members appointed by the President, for terms of seven years at annual salaries of $10,000 (£2,050). According to the bill compensation for ocean mail service shall be made according to the scale provided in the ocean mail act of March 3, 1891, with the proviso, however, that at the discretion of the Postmaster-General vessels of 15 knots speed shall be entitled to receive the maximum rate, vessels of 12 knots speed the second largest rate and vessels of 10 knots speed the third largest rate.

The equalization of building and operating costs of American vessels as compared with foreign vessels would be in the hands of the Merchant Shipping Board. One of its duties would be to gather and compile information concerning the differences between the cost of building and operating merchant vessels in the United States and in foreign countries. It would also be its duty to examine the navigation laws of the United States and make such recommendations to Congress as it may deem proper for the amendment, improvement and revision of such laws for the development of the American merchant marine. The Shipping Board would also be empowered to make regulations concerning the construction, equipment, structural strength and load line of vessels and their inspection and upkeep. It would also be the duty of the Shipping Board to investigate the legal status of mortgage loans on vessel property with a view to improving the security of such loans and encouraging investment in American shipping.

American Shipyards and Marine Repair Plants

Present Shipbuilding Facilities in the United States—Merchant Tonnage Under Construction—Recent Improvements

A THOROUGH canvass of over 50 shipyards in the United States has shown that practically every shipbuilding plant in the country which is equipped for building steel vessels is filled with work for at least two years to come at prices far above normal. Several new yards have been opened and the establishment of others is contemplated. In all, about 300 merchant vessels aggregating about 1,150,000 tons, are now under construction, while, in addition, about 70 government vessels, aggregating at least 150,000 tons displacement, are also being built in private yards, bringing the total volume of ship construction now in hand in the private yards up to about 370 vessels of 1,300,000 tons.

While the returns (as given in the accompanying table) upon which the above estimate is based are necessarily incomplete, they nevertheless measure with sufficient accuracy the present capacity of production of the principal shipyards in the United States. At no other period in the recent history of American shipbuilding have the facilities of the shipyards in the United States been so fully utilized for the construction of merchant vessels, and the result will be a material increase in the American merchant marine—although almost wholly for domestic use.

The Shipyards

Of the merchant vessels now building, 98 are freight steamships, 68 are oil tank steamers and 7 are passenger and freight steamships. Thirty of the vessels building are of 10,000 tons or over, 61 are of from 5,000 to 10,000 tons, and 35 are of from 3,000 to 5,000 tons. It is noteworthy that of the 30 vessels of 10,000 tons or over under construction, 19 are oil tankers, showing the unusual growth of the great oil-carrying fleets.

An insight into the facilities available in the United States for building ships can be gained from the descriptive articles in the following pages, which show briefly the extent of the equipment provided in the individual yards and the nature of the work turned out.

NUMBER AND APPROXIMATE TONNAGE OF VESSELS UNDER CONSTRUCTION IN PRIVATE YARDS FEBRUARY 18

Shipyard	Merchant Vessels		Government Vessels	
	No.	Gross Tons	No.	Displacement
American Bridge Company	22	10,533	..	....
American Car & Foundry Company	12	5,039	..	....
American Shipbuilding Company	20	81,300	..	....
Anderson Steamboat Company	4	....	1	360
Baltimore Dry Docks & Shipbuilding Company	7	24,500	1	750
Charles Barnes & Company	2	720	1	360
Clinton Shipbuilding & Repair Co.	2	560	..	....
Bath Iron Works	4	2,668	3	3,305
H. M. Bean	1	....	..	....
F. S. Bowker & Sons	2	1,134	..	....
A. C. Brown & Sons	3	....	..	....
Chester Shipbuilding Company	7	40,600	..	....
California Shipbuilding Company	..	....	6	....
Wm. Cramp & Sons Ship & Engine Building Company	12	75,200	4	4,360
G. G. Deering Company	1	1,900	..	....
Dubuque Boat & Boiler Works	2	85	..	....
J. F. Duthie & Company	1	....	..	....
Electric Boat Company	..	....	8	....
W. & A. Fletcher Company	1	....	..	....
Fore River Shipbuilding Corporation	9	80,000	20	....
Great Lakes Engineering Works	15	63,487	..	....
Harlan & Hollingsworth Corporation	13	85,000	..	....
Howard Ship Yards Company	7	4,600	..	....
Johnson & Lanteri	1	....	..	....
Johnston Brothers	..	....	2	800
Kelly-Spear Company	5	3,380	..	....
Lake Torpedo Boat Company	..	....	8	....
McKay Shipbuilding Company	1	550	..	....
Manitowoc Shipbuilding & Dry Dock Company	10	14,000	1	1,000
Maryland Steel Company	13	75,000	..	....
Mathis Shipbuilding Company	3	....	..	....
Mathews Shipbuilding Company	3	....	..	....
Merrill-Stevens Company	..	....	1	170
Moore & Scott Iron Works	3	9,000	..	....
Newport News Shipbuilding & Dry Dock Company	17	128,000	2	63,400
New York Shipbuilding Company	24	153,913	4	62,180
Percy & Small Company	1	898	..	....
Pusey & Jones	5	1,020	2	....
James Rees & Son Company	1	460	..	....
Sawyer Bros.	1	600	..	....
Seattle Construction & Dry Dock Co.	4	16,800	4	....
Skinner & Eddy Shipbuilding Co.	2	14,250	..	....
Spedden Shipbuilding Company	6	....	..	....
Staten Island Shipbuilding Company	6	1,683	..	....
Arthur D. Story	2	279	..	....
Tampa Foundry & Machine Company	1	2,000	..	....
The Texas Company	4	36,000	..	....
Toledo Shipbuilding Company	11	29,200	..	....
Townsend Marine Ry. & Cons. Co.	3	1,260	..	....
United Engineering Works	3	....	..	....
Union Iron Works	19	179,078	..	....

Additions and Improvements

Should future conditions warrant the large expenditures that would necessarily be required for materially increasing the present building facilities in the existing yards, the demand could be met without difficulty in many cases, as nearly all of the large yards when originally laid out were planned with a view to future expansion. Not infrequently the property owned by the shipbuilding company is only partly utilized at the present time for shipbuilding purposes, and with the water front available immediate expansion of the building facilities could be readily accomplished to meet any demands that might result from conditions promising a reasonably permanent growth of American shipping.

In practically all of the shipyards, however, the present unprecedented demand for merchant tonnage, although resulting from abnormal conditions, has led to a general expansion of facilities by the addition of new building ways, the erection of new shops and the installation of new machinery and other equipment. A striking illustration of this is the virtual reconstruction of the yards that in recent years have become subsidiaries of the Bethlehem Steel Corporation. In this group are the Fore River Shipbuilding Corporation, the Harlan & Hollingsworth Corporation and the Union Iron Works, where in every case the improvements have been on a scale that indicates a confident belief in the permanent growth of the American shipbuilding industry.

Conditions in the Repair Yards

Owing to the unusual conditions during the past eighteen months, when the scarcity of tonnage has brought into service every available vessel to take advantage of the profitable freight rates offered, the facilities for overhauling and repairing vessels of every type have been taxed to the utmost. As a result, new equipment has been called for and comprehensive plans for increasing the capacity of existing repair yards have been put into effect.

THE FORE RIVER SHIPYARD

Extensive Additions and Improvements Rapidly Increasing Capacity of Fore River Shipyard at Quincy, Mass.—New Shops and Building Slips

THE Fore River Shipbuilding Corporation is a subsidiary of the Bethlehem Steel Corporation and was established in its present location in 1900. Its predecessor was a smaller yard for the building of yachts and machinery located at Weymouth Landing about two miles from the present yard. As a result of the large amount of government work for the navy in 1900 because of the Spanish-American War the company at Weymouth Landing had received contracts for the torpedo boat destroyers *Lawrence* and *MacDonough* and for the sheathed protected cruiser *Des Moines,* and were low bidders for the battleships *New Jersey* and *Rhode Island.* The large amount of business necessitated the establishment of the larger and more modern plant which was established at Quincy Point on the Weymouth Fore River in the year 1900, in a location that had been celebrated for two centuries as a shipbuilding center for sailing vessels, one of the oldest shipyards in the United States having been located not far from the present plant.

The shipyard proper embraces an area of about 40 acres, and there is in addition a large amount of outlying property. It is about five miles from Boston Light, and in fact is nearer the open sea than the principal docks of the City of Boston. It is located on a completely land-locked harbor where it is safe from damage from the violent storms of the North Atlantic and well protected by the fortifications of Boston Harbor in time of war. It has a channel depth to the open sea at the present time of 30 feet of water at high tide. The mean draft of water at low tide at the company's wharves is 28 feet.

The shipyard is connected by its own railway line, 1⅝ miles in length, to the New York, New Haven & Hartford Railroad Company, Plymouth Division, at East Braintree. There are about 3½ miles of railroad line within the company's plant, so that material received can be delivered to any part of the plant and handled by overhead traveling cranes or industrial locomotive cranes to any point desired.

The shipyard has nine building slips, lettered from *A* to *J,* and all of these are now covered by overhead cranes. An addition slip, lettered *K,* is now under construction for handling merchant vessels any size up to 600 feet and fitted with two overhead traveling cranes capable of handling a maximum combined load at one time of 30 tons. The slips *A, B, C* and *D* have 5-ton overhead traveling cranes; slips *E, F* and *G* have two 10-ton traveling cranes, and slips *H* and *J,* which are under what is known as the overhead ship structure which was erected in 1901, are each fitted with two 5-ton cranes.

The company has under construction at the present time a ship fitters' shop for the handling, fabrication, assembling and riveting of structural steel which is worked into the ships. This shop is 775 feet long by 185 feet wide and when completed will be the best shop of its type

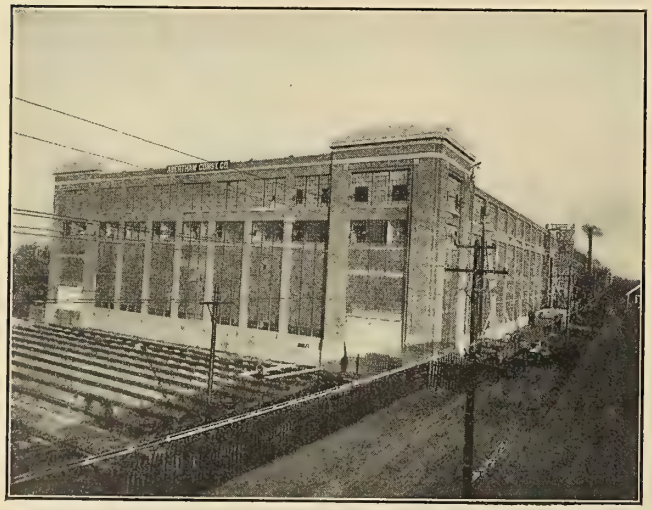


Fig. 2.—New Ship Shed

Fig. 3.—New Plate and Shape Storage Yard

Fig. 4.—Machine Shop

Fig. 6.—Main Office Building

in the United States. It is built of steel, brick and concrete and is practically fire proof in its construction, with the maximum amount of steel sash and natural lighting. It is divided into two bays about 90 feet span each, with two overhead traveling cranes in each bay, and underneath them on each side are a suitable number of wall cranes for serving the machines. There are, in addition, a large number of jib cranes for serving individual machines and each crane is fitted with an electric hoist. The building is equipped with a large amount of new machinery, new furnaces and other equipment.

The layout of the plate yard for stowing of structural material and of the narrow-gage railways for handling it at the end of the shop is shown in Fig. 3. The structural material is received in the yard on the cars and from them is handled by three gantry cranes. Two electric storage-battery trucks run into a bin at the end of the shop from which the material is lifted by overhead cranes to suitable locations for working. In addition to the crane facilities at the end of the shop, there are other storage-battery trucks for handling material lengthwise in the shop and at the far end across the slipways each of the existing slipways is to be extended about 300 feet, so that all material delivered through a large door in the side of the shop at the far end can be handled in a straight line out of the shop and delivered under any one of the slipways, where it can be handled directly to its place in the ship with the overhead traveling cranes.

The second floor of the new shop has a mold loft 600

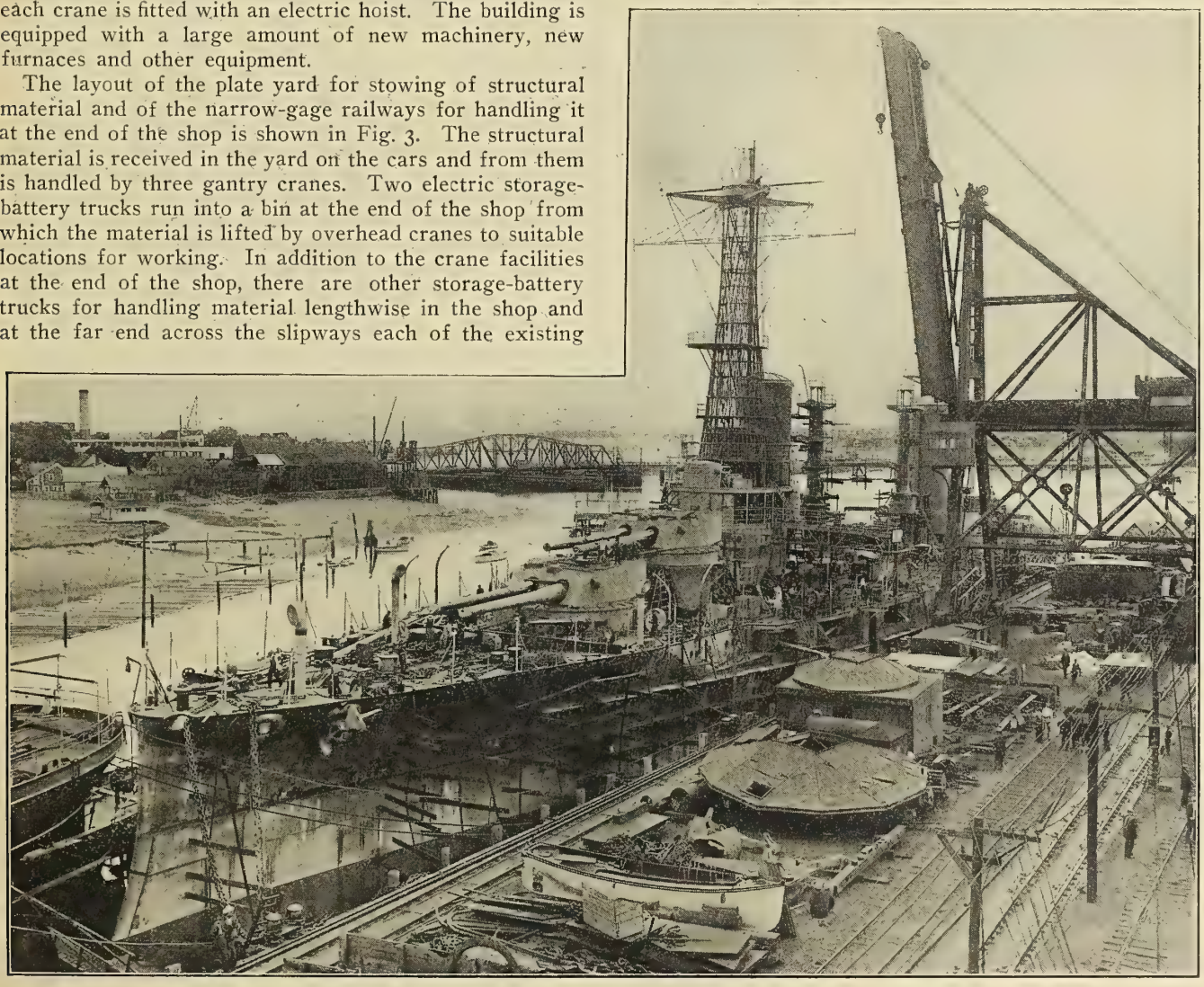


Fig. 5.—Fitting Out Berth, with Argentine Battleship *Rividavia* Under Construction

feet long by 100 feet wide, the largest of its type known. It has, in addition, a sheet metal shop, which is to be transferred from its present location to these new and better equipped quarters. Every tool and appliance fitted in the shop is being installed with a careful regard not only to its efficient operation but to the safety of the workmen. Ample and thoroughly sanitary washrooms and toilet appliances are being fitted for every man employed in the shop. A large number of offices for yard inspectors on the general superintendent's staff are being constructed on a mezzanine floor at the height of the first floor trusses.

berthed, the material is handled on board the vessels by means of industrial cranes.

For the distribution of material around the yard the company has in continual operation two locomotives and 24 flat cars, four industrial cranes which can lift 15 tons weight; and for the handling of miscellaneous small material there are two auto trucks, one gasoline (petrol) of 3½ tons capacity, and the other, electric, of two tons capacity.

In addition to the structural iron work department, the yard is equipped with all other machinery required for the

Fig. 7.—Interior of Machine Shop

Coal and some shipments of lumber are received by water, but all other shipments of whatever character are received by rail.

For ships completing in the water there is dock space, as shown in Fig. 5, where there is a minimum depth of 28 feet alongside the long dock, and which is served by a traveling gantry crane with a maximum lifting capacity of about 100 tons, and which has actually placed turrets weighing 92 tons in position at the center line of a battleship.

There is now under construction, 350 feet across from the present long dock, a new sea wall, 500 feet in length, for the mooring of a battleship or large ships of any type. It is expected later to extend this wall an additional 500 feet, to furnish better docking facilities for larger vessels.

In another basin or wet dock where smaller boats are

building of high grade merchant or government vessels as well as any grade of cargo boats.

The machine shop shown in Figs. 7 and 8 is 520 feet long and 118 feet wide, fitted with overhead cranes running the entire length of the shop. The extension at the far end of the shop, which is steel, brick and concrete construction, was built last year for the installation of some large surfacing plates inside of the shop. This new end construction represents the type of construction that will replace the entire wooden building within two or three years. Some of the special machines in this shop are as follows:

Boring mill for turret track with a swing of 32 feet; 120-inch planer; large lathe for turning shafting, capable of boring a shaft 50 feet long; a specially constructed lathe for turning turbine rotors up to 12 feet in diameter, and

a machine for the planing of propellers, shown in Fig. 9.

There is probably no shipyard machine shop in the country equipped with an equal amount of up-to-date machinery. At times an output in excess of 1,000,000 pounds machined material per month has been reached. All of the heavy work is done on the main floor, which is served by the overhead cranes mentioned before, and there are two galleries, running the entire length of the shop, on which the lighter grades of work are done; one gallery of which is devoted entirely to brass work. This shop has employed at times as many as 750 men working in two and three shifts.

The pipe shop is equipped with all the necessary tools for the cutting, threading, bending and working of iron, steel, brass and copper piping. There is also a sheet metal shop for all kinds of light sheet metal work, special brass work and wire work.

The shipwrights, joiner and patternmakers' shop has up-to-date equipment of machinery and ample space for handling all kinds of wood work. Plans are now being prepared for the construction of a new pattern, joiner and shipwright shop, which, when completed, will permit the removal of the old wooden building which marks the site of the future power house.

The brass foundry, where all the brass castings for the plant are made, had an output for the month of January, 1915, of 339,000 pounds of good castings; an output which it is believed has never been equaled in a foundry of this size anywhere.

The blacksmith shop is up to date in every particular; and there is an electric workshop and a rigging loft; also a galvanizing plant with a capacity in excess of 250,000

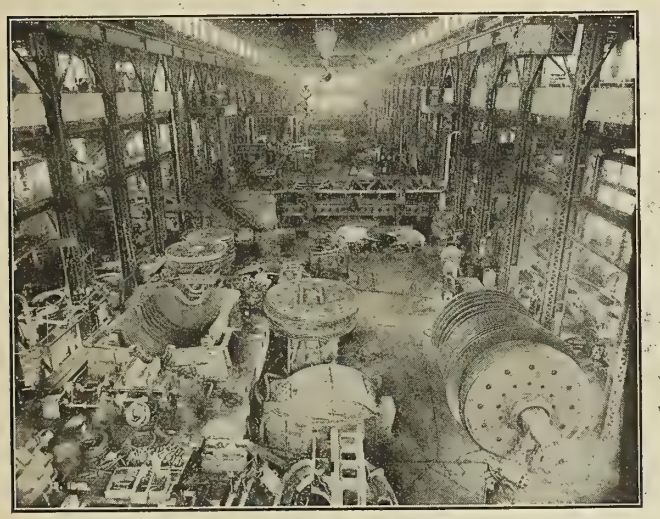


Fig. 8.—Curtis Turbines Under Construction in Machine Shop

pounds per month; a boiler shop for the building of water-tube boilers, and small buildings required for the construction of various auxiliaries used in shipbuilding.

A special feature of the plant is a new storehouse, of brick and steel and concrete construction, consisting of a basement and three complete floors, and a mezzanine floor. The main floor is fitted with an overhead crane for the handling of heavy material and an elevator is provided for serving the other floors. This building was recently constructed and is intended to handle in the most efficient manner all raw material, also the semi-finished and finished material used in the construction of ships, except plates and shapes and the larger castings. The interior shelving, bins, etc., are entirely of metal and have been laid out with great care, due to the efficient handling of the various types of material. It is believed that the question of the efficient storage under cover of all materials, which go to make up a complete ship, has received, for the first time, the attention which this important service demands.

During the fourteen years of its existence the corporation has built and completed or has under construction 165 vessels, including five battleships, the *Rhode Island, New Jersey, Vermont, North Dakota,* for the United States Government, and the *Rividavia* for the Argentine Government; and at the present has under construction the battleship *Nevada* for the United States Navy. It has built a large number of submarines for the United States Navy, and several for foreign governments. It has built Curtis turbines for the Japanese Navy and for the Italian Navy.

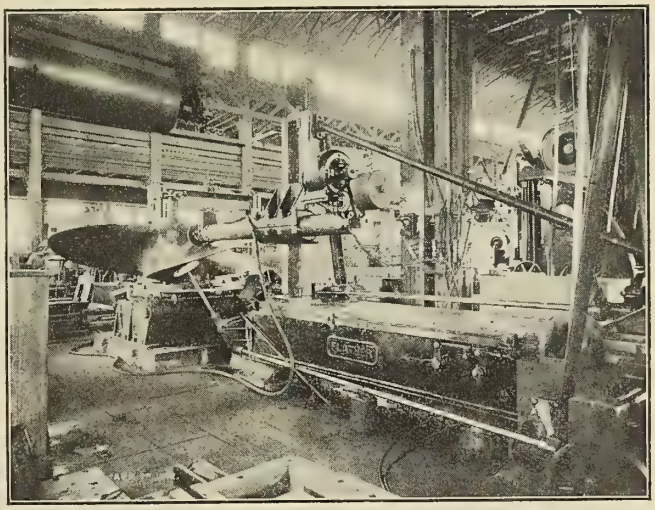


Fig. 9.—Propeller Planing Machine

Three of the United States battleships built at this yard made the trip around the world in 1907 and 1908. The corporation also performs miscellaneous work in addition to its shipyard work proper.

The corporation is at present employing about 4,500 men with a weekly payroll averaging $65,000 (£13,300).

The installation of a power plant with gas-driven machinery is contemplated, the gas to be produced from a suitable plant in the company's works. This plant will be of ample capacity for furnishing all of the pneumatic and electric power required in the company's business. There will be in addition an auxiliary steam plant for heating and other purposes.

Standard Shipbuilding Corporation

The Standard Shipbuilding Corporation, New York, which has taken over the shipyard property on Shooter's Island, Borough of Richmond, New York, is planning to build stock cargo steamships of about 7,400 tons of 23 feet draft, with a speed of 10½ knots with coal as fuel and 11½ knots with oil as fuel. The propelling machinery will consist of Scotch boilers and triple expansion engines. The company has purchased sufficient steel plates and shapes to build three of these vessels, and will proceed with their construction as rapidly as the necessary material is delivered. It is expected that the first of these vessels will be completed about the last of this year and one about every two months thereafter. The company's plant, which has remained idle for a number of years, will also provide facilities for dry docking and ship repairs.

Annual Meeting of Institution of Naval Architects.—The annual meeting of the Institution of Naval Architects will be held in the hall of the Royal Society of Arts, John street, Adelphi, London, W. C., on April 12 and 13.

Bath's Leading Shipyard

New Tools and Other Equipment Added to the Plant of the Bath Iron Works, Ltd.

The largest shipyard in Bath, Me., and until the present time the only shipyard in this "famous city of ships" to engage in the construction of steel vessels, is the Bath Iron Works, Limited, a plant which has a well-deserved reputation for its success in the construction of fast steam vessels. The company now has under construction in its splendidly equipped plant three torpedo-boat destroyers for the United States Navy, two of which are about ready for launching, a 225-foot destroyer-type of turbine-driven yacht for Mr. P. W. Rouss of New York, another steam yacht of similar design, 240 feet long, for Mr. John Willys, manufacturer of the Overland automobile, and two large car floats for service in New York Harbor. While this company has specialized in the construction of high speed naval vessels its success in the building of high speed merchant and pleasure boats has been no less marked.

The plant is up to date in every particular. The shops are nearly all of brick, steel or concrete construction, well lighted and ventilated. The various departments include a machine shop and boiler shop, where Parsons turbines and Normand express boilers are built, a copper and tin shop, a pipe shop, a blacksmith shop, a carpenter and joiner shop and a foundry; so that when a ship is contracted for by the Bath Iron Works the entire ship can be built in its plant. Nearly 1,000 men are employed in the plant, and the fact that labor troubles are practically unknown goes a long way to prove that the cooperation of officials and employees has made this successful plant what it is to-day.

During the last year the plant has greatly increased its efficiency by the installation of many new tools, etc., such as a new 26-foot plate rolls and a 5-inch horizontal boring mill and vertical boring mill in the machine shop, so as to meet the exacting requirements of high speed work, and a 5-ton overhead crane which facilitates the handling of all large plates in the plate yard.

The company was one of the first to take out a license for the construction of the Parsons marine steam turbine and during the past nine years has built and is building 19 vessels equipped with these turbines, of a total horsepower of 240,900, or a larger amount built and building than by any other of the American licensees.

They are also American licensees for the building of Normand express watertube boilers, of which they have

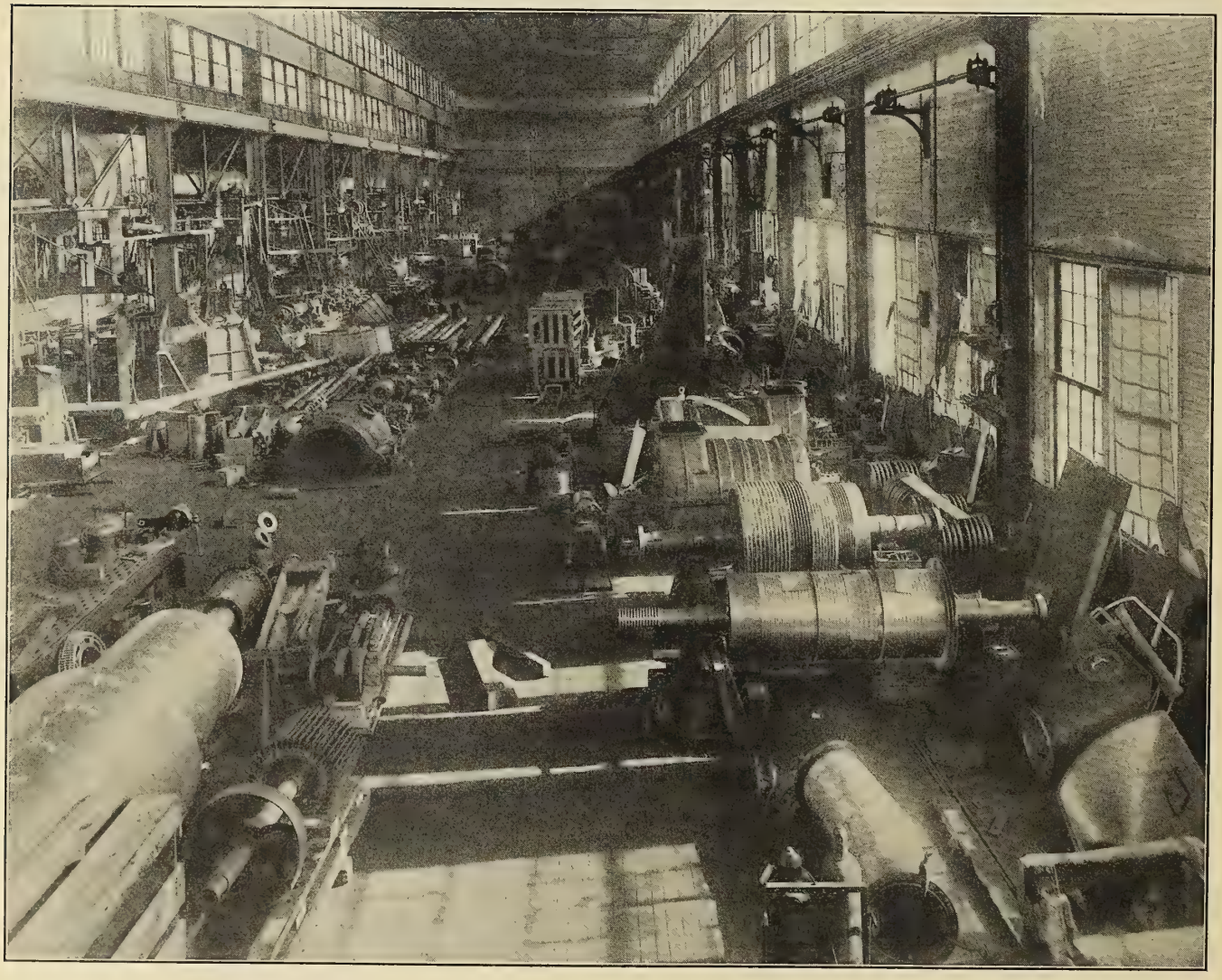


Fig. 1.—Machine Shop of the Bath Iron Works, Showing Parsons Turbines Under Construction

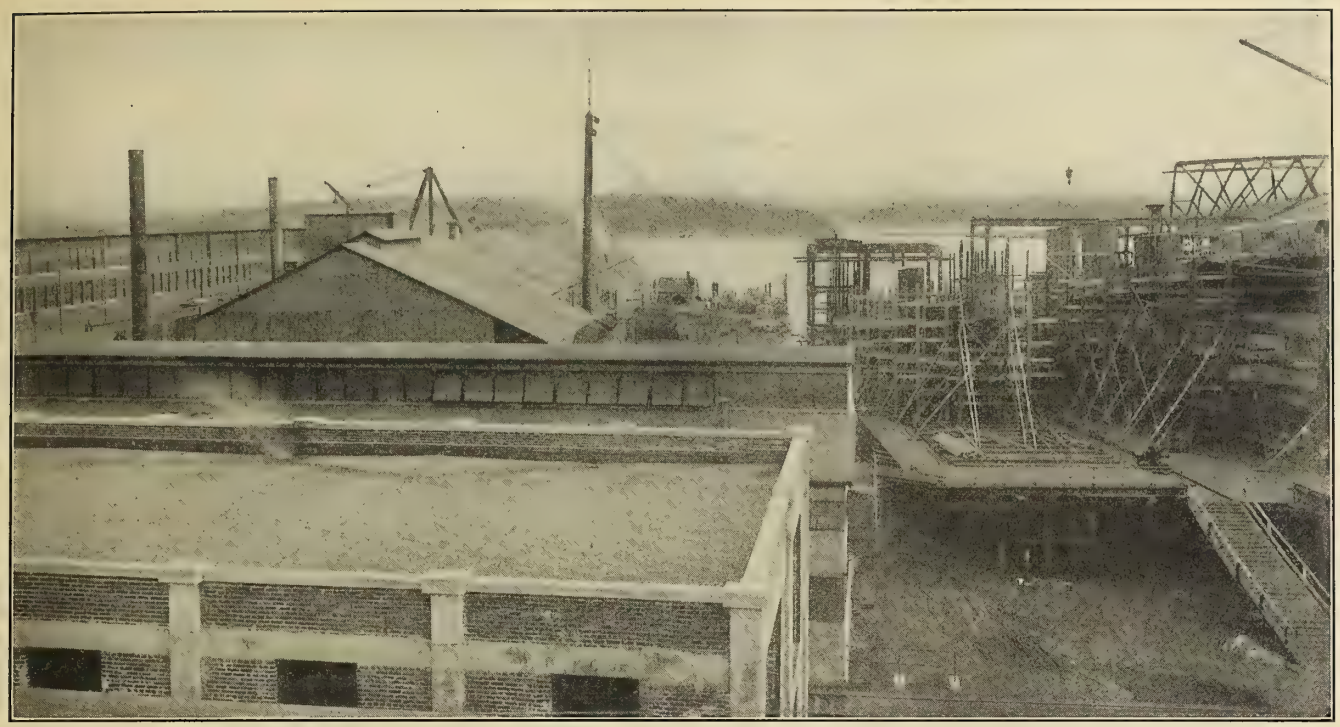


Fig. 2.—Partial View of Building Slips and Shops of the Bath Iron Works

constructed 85, having a total heating surface of 364,203 square feet, and with which all the high-speed vessels built by them have been equipped.

The last nine destroyers built by the Bath Iron Works are equipped with oil-burning apparatus, and the three destroyers now being built by them are also to be oil burners and to be equipped with Normand boilers and Parsons turbines.

Through their experience in building work of the character of that on which they have been engaged, the company has accumulated a very valuable mass of data and thorough experience.

For the installation of machinery on board vessels the company has a steel, electrically operated wharf crane of 75 tons capacity. A large repair business is done. They also build boilers of all kinds, tanks, pulp mill digesters and machinery, penstocks, stand pipes, and general boiler, machine, smith, copper and sheet metal, piping, plumbing and brass foundry work. The plant is compactly laid out on a plot about 700 feet square.

Shipbuilding on the Kennebec

Wooden Shipbuilding Active—New Steel Shipbuilding Plant for the Texas Company

That the year 1916 bids fair to be the banner year in shipbuilding on the Kennebec river is shown by the work now in progress in the shipyards of Bath and its vicinity. In the yard of Frank S. Bowker & Son, five miles down the Kennebec from Bath, the keel has been laid for a three-masted schooner of about 650 tons burden. The G. G. Deering Company will shortly deliver from its yard at the south end of the city a five-masted schooner of 1,800 tons gross, and as soon as the material arrives at the yard the keel of another schooner of the same size will be laid.

Only a stone's throw from the Deering plant in the yard of the Percy & Small Company, a four-masted schooner suitable for any trade (one of the most popular types of sailing vessels) is on the stocks. After the vessel is launched in March work on another vessel of the same type will be commenced immediately.

The Bath Iron Works, the next yard in line coming up the river, is extremely busy, having under construction three torpedo-boat destroyers, two large steam yachts and two steel car floats. A further description of this plant will be found elsewhere in this issue.

Further up the river the plant of Arthur Sewall & Company, builders of many of the finest and largest sailing vessels that have carried the American flag overseas, has been leased to the Texas Company of New York, which has a large crew at work putting the yard in shape to build four steel steamers of 9,000 tons each. The Texas Company expects to have two of these steamers on the stocks by June 1. After the first four steamers are completed it is likely that other vessels will be laid down, as the yard has been leased for a long term. The Texas Company intends to utilize local labor as much as possible, as some of the best ironworkers in the coast yards were formerly wooden shipbuilders on the Kennebec.

At the extreme north end of the city the Kelly-Spear Company is now completing two railroad terminal scows for New York owners and one coal barge.

In addition to the shipyards mentioned above, Bath is the home of the Hyde Windlass Company, manufacturers of windlasses, steam stearing engines and propellers. The efforts of this company, combined with those of the shipbuilders, have won for Bath the title of the "city of ships."

The Cramp Ship and Engine Building Plant

Burmeister & Wain Diesel Engines to be Built at the Cramp Yard—New Shops and Equipment

The famous Cramp shipyard, founded in Philadelphia eighty-six years ago by the late William Cramp, is not only the pioneer among the large shipyards now established in the United States, but has steadily maintained a foremost place in this important industry, both at home and abroad. At present the plant, which embraces the Cramp shipbuilding yard, the Kensington Shipyard Company, which is used for dry-dock work and repairs, the I. P. Morris Company, machinists and iron founders, and the Federal Steel Foundry Company, manufacturers of steel castings, occupies an area of sixty-five and one-half acres, with a water front of 2,058 feet. In all there are nine building slips, two of which were only recently added; a large dry dock; two smaller marine railway dry docks, and two fitting-out berths.

New Shops and Equipment

Extensive improvements are now under way, including the construction of a large new ship shed, two cranes for the wet dock, two new building slips with three new cranes, and a new office building. Sixteen vessels are now under construction in the yard, including four United States torpedo-boat destroyers, seven oil-tank steamships, two passenger and freight vessels, two freight steamers and a car ferry, furnishing employment for about five thousand men.

The William Cramp & Sons Ship & Engine Building Company has recently acquired from Messrs. Burmeister & Wain, of Copenhagen, Denmark, the rights to build the Burmeister & Wain Diesel marine engine in the United States.

Two of the building slips are 850 feet long and 110 feet wide, two are each 630 feet long, one being 110 feet wide and the other 83 feet wide; two are 600 feet long and 69 and 66 feet wide, respectively; two 400 feet long by 54 feet wide, and one 320 feet long by 35 feet wide. Four of the slips are served by overhead traveling cantilever cranes of 14 tons capacity; two are served by four 10-ton overhead electric traveling cranes; two are served by three 10-ton stationary electric cantilever revolving tower cranes, and one by stationary jib cranes.

Dry Docks

The large dry dock is 432 feet 11¾ inches long over all and 45 feet wide at the bottom and 111 feet wide at the top, while the entrance is 48 feet wide at the bottom and 69 feet wide at the top. The dry dock is fully equipped with a separate machine shop, pattern shop, ship shed, joiner shop, power house, wood finishing department, paint shop, boiler house, rigging department, pipe shop and storehouse. Of the two marine railways, one is of 3,000 tons capacity, 270 feet long over keel blocks and 48 feet 10 inches wide, while the other is of 1,000 tons capacity, 240 feet long by 35 feet wide.

The two fitting out berths, one of which is 990 feet long by 188 feet wide, and the other 450 feet long by 55 feet wide, are served by stationary electric cantilever tower cranes of 10 and 20 tons capacity, respectively. There is also a 100-ton floating derrick crane, the first, and for many years the largest, crane of its type in the United States. Electric power for distribution to the shops and yard tools is furnished by two power plants, one housed in a two-story building, 132 feet by 60 feet, and the other in a three-story building 72 feet by 60 feet.

The various shops in the yard are of unusual size and capacity. They include three machine shops, the first a two-story building 458 feet by 140 feet, the second a three-story building 142 feet by 333 feet, and the third, of U-shape, 320 feet by 250 feet by 230 feet by 66 feet. The iron foundry consists of two buildings 450 feet by 110 feet and 130 feet by 110 feet. The smith shop is 290 feet long by 100 feet wide; the joiner shop is a two-story building 190 feet by 80 feet; the electrical department is a two-story building 165 feet by 66 feet; the paint shop is a two-story building of L shape 210 feet by 95 feet by 32 feet; the ship shed is also a two-story building 540 feet long by 212 feet wide; the boiler shop is 330 feet long by 160 feet wide, and the pattern shop is 338 feet long by 60 feet wide. The old ship sheds are 440 feet by 150 feet and 150 feet by 60 feet, while the old paint shop is a two-story building, 194 feet by 50 feet. The plant also includes a brass foundry, consisting of two buildings, one 111 feet by 336 feet, and the other a three-story building 200 feet by 34 feet; a galvanizing department, 142 feet by 50 feet, a pipe shop 120 feet by 90 feet, and a two-story storehouse 227 feet by 32 feet.

Six railroad sidings enter the plant at various points from the tracks of the Pennsylvania and the Philadelphia & Reading Railroad.

The Cramp shipyard has always figured prominently in naval construction work, and among the historic vessels built in this yard for the United States Navy were the armored cruisers *New York* and *Brooklyn*, the triple screw protected cruisers *Columbia* and *Minneapolis*, and the battleships *Indiana*, *Massachusetts* and *Iowa*, all of which in their day marked distinct advances in steel warship construction. This yard was no less conspicuous in the early days of the American merchant marine, having built two of the large vessels which have been successfully operated by the American line for over twenty years. These vessels have been followed in later years by a continually increasing number of both merchant and naval vessels of all types, including such vessels as the battleship *Wyoming* and the fast turbine-driven passenger liners *Great Northern* and *Northern Pacific*.

Mathis Yacht Building Company

The Mathis Yacht Building Company and the John H. Mathis Company, located in Camden, N. J., are operated jointly for building all classes of yachts and pleasure boats from 50 to 125 feet in length of wood, as well as for repairing schooners, barges and larger yachts.

At the present time the Mathis Yacht Building Company is turning out high-speed yachts that will make from 25 to 35 miles an hour. These boats average in length from 50 to 60 feet and require double planking. A new building has been put up to take care of the extra amount of this work now on hand. A vessel of special interest now under construction is a 125-foot high-class passenger boat to be equipped with two 150-horsepower Diesel engines. The Mathis Yacht Building Company also has a railway suitable for hauling out yachts and also ample wharfage space for taking care of such vessels.

The John H. Mathis Company has a large marine railway for hauling out schooners, barges and larger yachts for repairs. The water front extends for 1,000 feet along the Delaware, and up-to-date equipment is available for building large wooden vessels. The company now has under construction two 250-foot car floats for the Philadelphia & Reading Railroad.

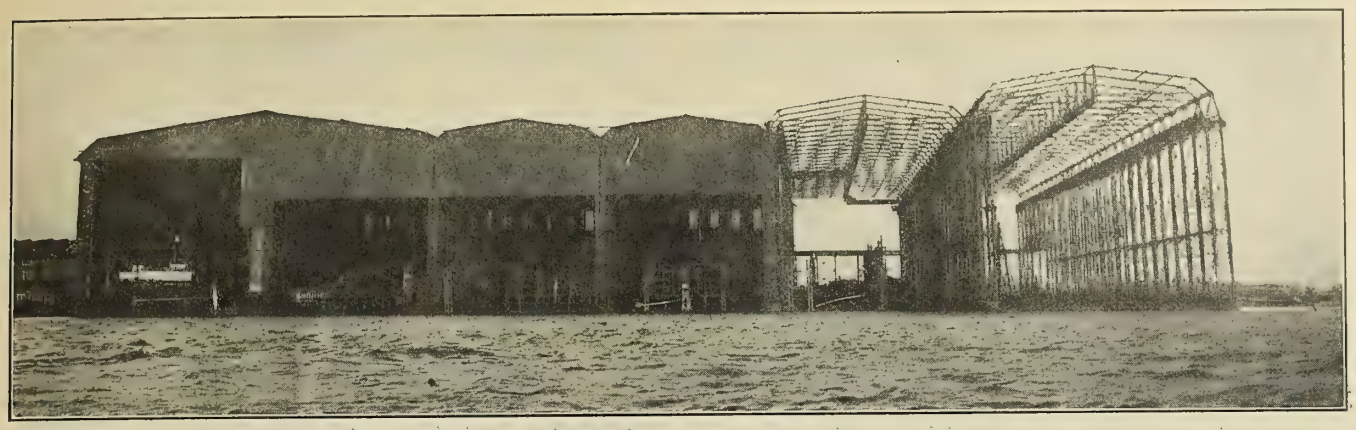


Fig. 1.—New and Old Building Slips of the New York Shipbuilding Company

The New York Shipbuilding Company

Large Shipyard Housed in One Continuous Building—Manufacturing Methods Applied to Ship Construction

The largest amount of tonnage under construction in a single shipyard in the United States at the present time is at the plant of the New York Shipbuilding Company, Camden, N. J., where no less than twenty-eight vessels, twenty-four of which, aggregating 153,913 gross tons, are merchant vessels, and four, totaling 62,180 tons displacement, are naval vessels. The value of the merchant work in hand amounts to about $10,000,000 (£2,050,000), and this, with the naval work, brings the total value of the work up to over $23,000,000 (£4,700,000).

Four thousand men are employed at the yard, and its facilities have been extended by the addition of a new building slip served by two 15-ton cranes. The property on which the plant is located has a water frontage of one-half mile, and there is ample space for doubling the capacity of the yard should the volume of business make further expansion practicable.

This plant is unique in that, with the exception of the woodworking and pattern departments, all of the various shops and building ways are arranged conveniently in one continuous building. The plant was laid out sixteen years ago with a view to applying, so far as possible, manufacturing methods to the construction of vessels. The mold system of structural fabrication was developed to such an advanced degree and the various shops so thoroughly equipped with machinery and traveling cranes and conveyors that the work is carried out with remarkable rapidity with a minimum amount of manual labor.

The compact group of buildings includes a plate receiving and distributing shed where structural material is received and handled by a gantry crane. This shed is adjacent to the boiler, drop forge, angle, plate, machine and blacksmith shops, in which the material is handled by overhead traveling cranes which overrun the gantry crane in the distributing shed.

After the material is fabricated in the shops it is carried directly to the ship ways by low gantries, which deliver the material directly to the overhead cranes over the building slips. At one end of the immense building, adjacent to the building slips, is a fitting-out basin, or wet dock, which is served by an overhead crane of 100 tons capacity capable of handling heavy machinery. This crane can also be transferred to the building slips, so that heavy machinery can be placed on the vessels before launching if desired.

Of the vessels now building at this yard, two are battleships of the superdreadnought type for the United States Navy; two are torpedo boat destroyers; nine are oil tank-

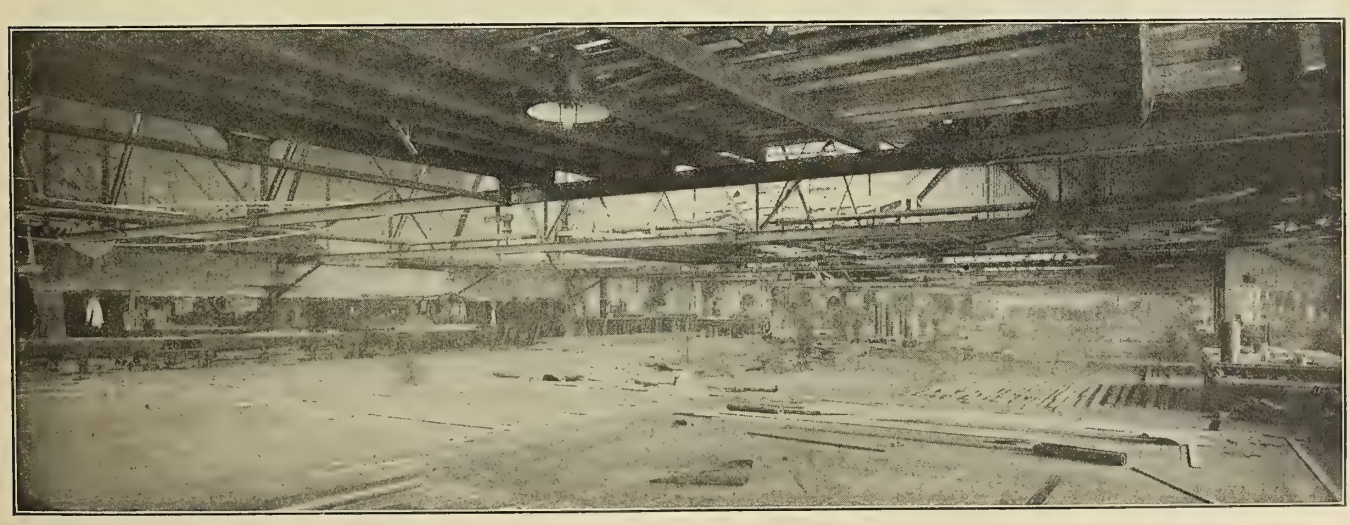


Fig. 2.—Mold Loft of the New York Shipbuilding Company

ers; six are colliers, and eight are car floats. As far as the merchant vessels are concerned, all of the vessels now building are adapted to special trades for carrying cargoes in one direction; for this reason the structural work has been highly standardized, and the result is as nearly a manufactured product as the building of vessels can be. During the sixteen years of its existence the company has built 166 vessels, and, with the present influx of orders, the capacity of the yard for rapid production has been so highly developed that on the average one large vessel is now launched each month.

Staten Island Shipbuilding Company

The Staten Island Shipbuilding Company, Port Richmond, N. Y., which operates two plants, one at Port Richmond, which covers 8 acres, with a water front of 500 feet, and the other at Mariner's Harbor, which covers 20 acres, with a water front of 1,200 feet, is increasing its facilities to build steel ships up to 7,500 tons. The company executes repair work valued at about $1,000,000 (£205,000) each year, and now has under contract the construction of harbor vessels amounting to about $500,-

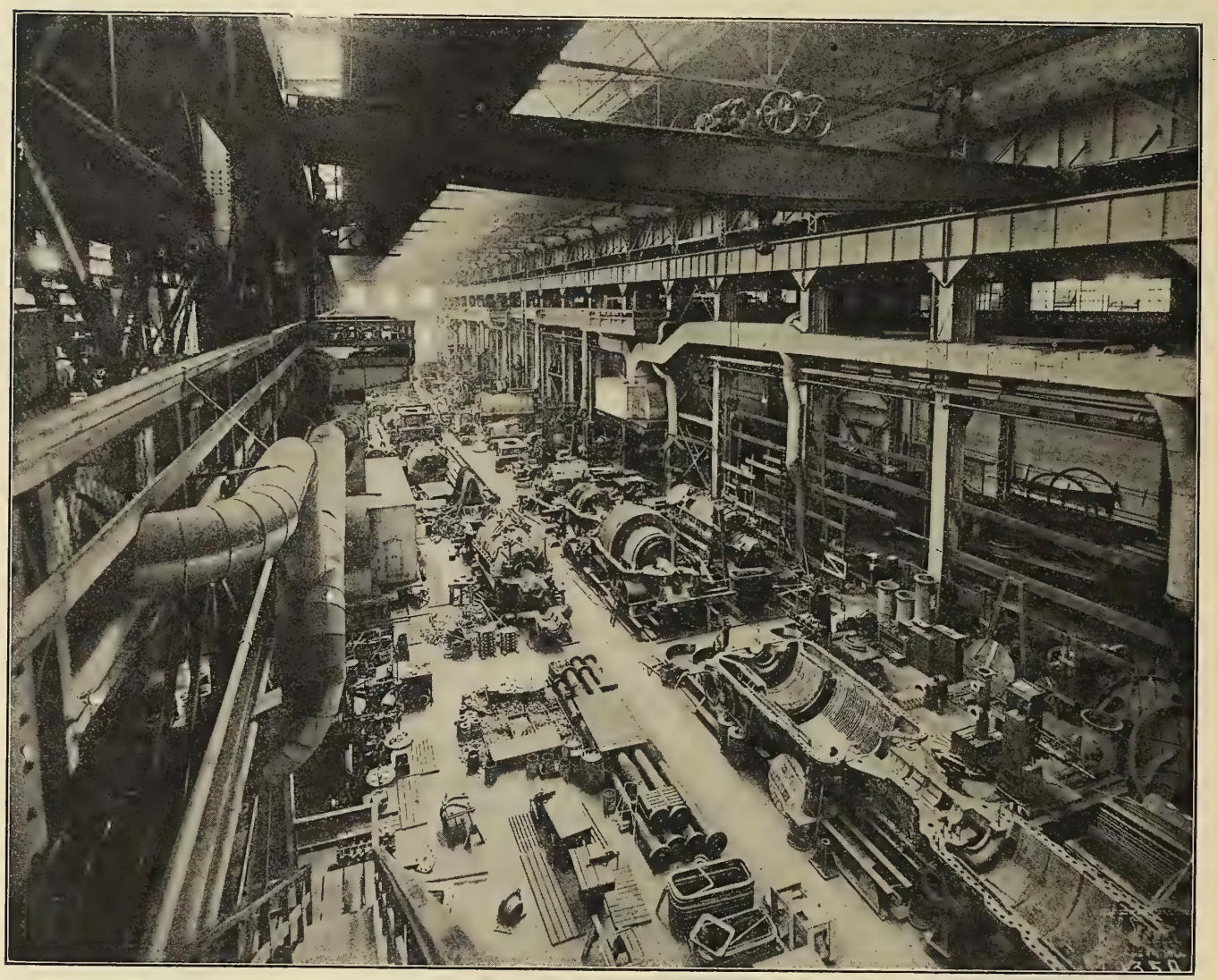


Fig. 3.—Machine Shop of New York Shipbuilding Company

Shipping Destroyed by War Operations

According to reports compiled by the *Journal of Commerce,* approximately 990 vessels of all classes and types, with an estimated gross tonnage of about 1,878,003 tons were destroyed directly or indirectly as a result of the first seventeen months of the European war. England lost 602 vessels of 1,192,551 gross tons; Germany, 65 vessels of 161,888 gross tons; France, 54 vessels of 125,978 gross tons; and Norway, 77 vessels of 103,023 gross tons, while the remaining vessels lost belonged to Denmark, Sweden, Holland, Russia, Greece, Spain, Japan, Italy, Turkey, Belgium, Austria and the United States. Of these, however, only seven vessels, aggregating 14,087 gross tons, were American vessels.

000 (£102,500). The company has not experienced a slack period during the last five years, and regularly employs from 800 to 1,000 men.

The plant at Port Richmond has four building slips capable of accommodating vessels up to 300 feet in length, and three dry docks, the largest of which has a capacity for 3,000 tons. The plant at Mariner's Harbor has three building slips, which are now being equipped for handling vessels up to 7,500 tons, and three dry docks. All of the dry docks are of the floating dry dock type, built of wood, with motor-driven equipment.

At the Port Richmond yard, where the construction consists principally of tugs, barges, lighters and smaller vessels for harbor equipment, the machine shop is equipped with tools which are nearly all new, and has a

capacity for building four engines up to 3,000 horsepower at one time, in addition to the usual repair work. It is proposed to build an erecting shop at the end of the machine shop, which will increase its capacity so that engines up to 4,000 horsepower can be built. The boiler shop at this plant has a capacity for turning out twenty Scotch boilers per year. For repair work there is an electric welding plant and seven gas machines for cutting. It is proposed to build a plant for generating gases for these machines. All of the shops at this plant, except the boiler shop and power plant, are of wood, and all of the shops are equipped with automatic sprinklers.

Formerly the Mariner's Harbor plant was used exclusively for the construction and repair of wood vessels, but at the present time the plant is being fitted up for the construction of large steel ships. For this purpose a ship shed and the necessary yard tools and cranes will be provided. The machine shop is 100 by 40 feet, and near the plant an iron foundry 100 feet by 100 feet, with a capacity of 10 tons, is being erected.

Power at both yards is generated by producer-gas power plants built by the company. The power plant at the Port Richmond yard is of 1,000 horsepower, and that at the Mariner's Harbor yard 500 horsepower. All of the machinery in both plants is operated by electrical drive.

In addition to its shipbuilding and repair work, the company is now perfecting a marine oil engine of the semi-Diesel type, which will be on the market in about six months.

Material is brought to the yards by rail, and in addition the company owns two auto trucks of 3½ and 1½ tons capacity, respectively, and two gasoline (petrol) launches for the delivery of supplies.

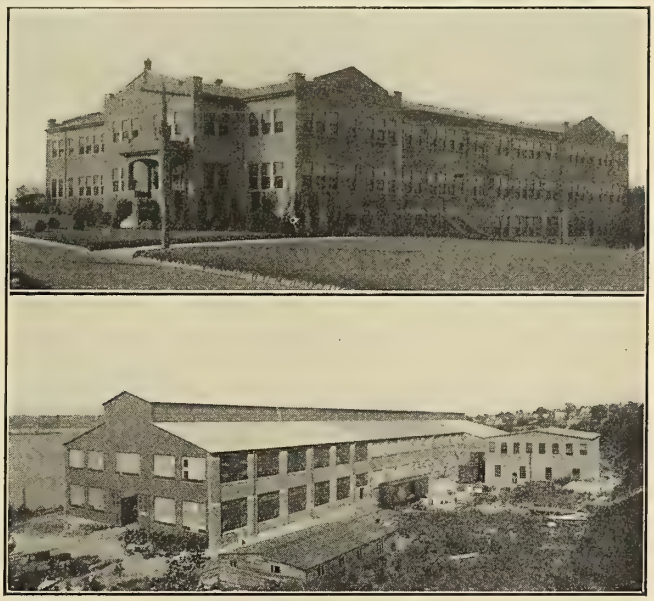
Progressive American Diesel Engine Building Company

The first firm in the United States to take up on an extensive scale the construction of heavy oil engines of the Diesel type for marine purposes was the New London Ship & Engine Building Company, Groton, Conn. As first organized, the company was capitalized at $500,000 (£102,500). The plant, consisting of an engine-building shop 106 feet long, was placed in operation in May, 1911. Additions to the plant were made in 1912, and again in 1915, and the capitalization of the company has been increased to $3,500,000 (£717,500). At present 1,000 men are employed, working day and night in two twelve-hour shifts. That the plant has been eminently successful is shown by the fact that four months after operations were begun a 2 percent quarterly dividend was paid, and since that time this quarterly dividend has never been passed.

At the present time the plant consists of the main machine shop, 600 feet long, one-half of it being 130 feet wide and the other half 100 feet wide. The building is of monitor construction, with the center bay served by a 25-ton capacity traveling crane. In addition to the main engine-building shop there is a two-story pattern shop, 60 feet by 70 feet, and a pipe shop, 50 feet by 120 feet. A new foundry, 180 by 80 feet, is now being constructed, and within about two months the first castings will be made. The company also contemplates building a forge shop, and a larger pattern and pipe shop, as well as a new storehouse.

The property on which the plant is located, which is the site of the former Eastern Shipyard, where the Great Northern 13,323-ton steamships *Dakota* and *Minnesota* were built twelve years ago, covers 33 acres, and at the north end of the property there is ample room for the construction of hulls for motor ships. There is a depth of 18 feet of water at the end of the company's dock, and, with the space and equipment available, the plant should be an ideal place for the construction of large motor ships, a type of vessel which is rapidly gaining favor among American shipowners.

The major output of the company up to date has been Diesel engines for submarines built by the Electric Boat Company. The company can build units up to 3,000



Upper View—Office Building of the New London Ship & Engine Building Company and of the Electric Boat Company
Lower View—Shops Where the Nlseco Diesel Engine is Built

horsepower, and during the last ten months 175 Diesel engines, aggregating about 50,000 horsepower, have been turned out. Forty engines of 240 horsepower each were built in four months and ten more are now under construction. The company is now building two 360-horsepower engines, and about two years ago nine small 100-horsepower engines were built and kept in stock for sale. All except two of these engines have been sold and installed principally in work boats.

F. O. Smith Shipbuilding and Dry Dock Company, Inc.

One of the busiest repair yards at Norfolk is the F. O. Smith Shipbuilding & Dry Dock Company, Inc., which employs between 100 and 200 men, and now has on hand work valued at about $40,000 (£8,200). The plant originally had a floating dry dock with a capacity of 2,000 tons, but during the last year a third section has been added to this dock, increasing its capacity to 3,000 tons. The company's marine railway, which is 225 feet long and has a capacity of 1,000 tons, has also been rebuilt with a new foundation, chain gearing, etc., making the expenditures for improvements amount to approximately $75,000 (£15,370).

While the plant is equipped for building tugs and barges, it makes a specialty of general repairs to steel and wooden vessels. It is conveniently located near the center of the city and is completely equipped with electricity, compressed air and oxy-acetylene and electric welding plants.

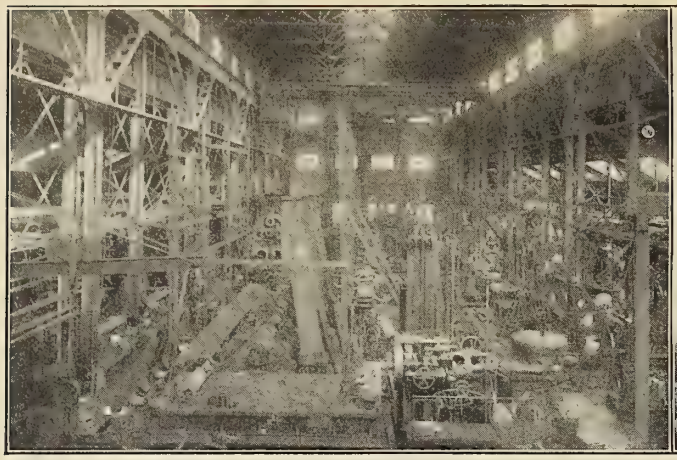


Fig. 1.—Interior of Old Machine Shop

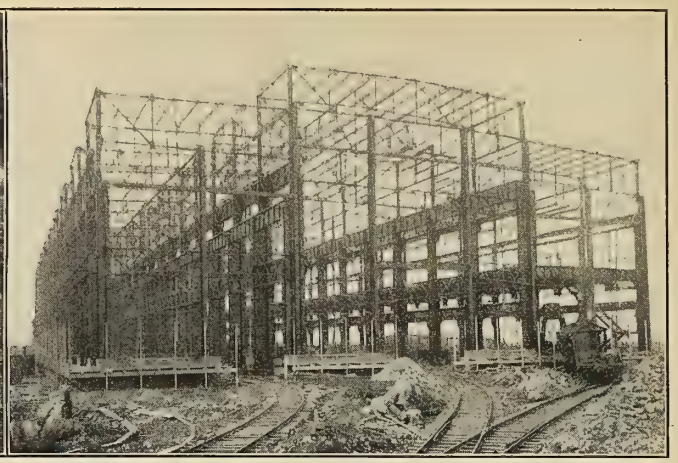


Fig. 2.—New Machine Shop Under Construction

Shipyard of the Maryland Steel Company

Extensive Additions Under Way to Meet Increased Orders for New Merchant Ships—New Building Ways and Shops

Nine months ago the marine department of the Maryland Steel Company, Sparrows Point, Md., which is the tidewater plant of the Pennsylvania Steel Company, had under contract nine vessels valued at about $4,500,000 (£922,500), and for this work was employing 2,400 men. To-day the company has under construction thirteen vessels, aggregating over 75,000 gross tons, valued at about $10,500,000 (£2,150,000). The company is now employing 3,500 men.

On February 18 a formal announcement was made that the Pennsylvania Steel Company had passed into the hands of the Bethlehem Steel Corporation. The shipyard of the Maryland Steel Company, therefore, has become a subsidiary of the Bethlehem Steel Corporation, making the fifth large shipyard controlled by this corporation.

Needless to say, the company's facilities are taxed to the utmost, and in order to meet the situation the company is making extensive additions to its equipment. One of the first changes made in the yard was the combination of two small building ways into one large one capable of accommodating vessels up to 550 feet long by 72 feet beam. In addition to this, an entirely new ways has been constructed capable of handling vessels up to 650 feet long by 78 feet beam.

For handling material on the new ways four electrically operated traveling power cranes of 12½ tons capacity

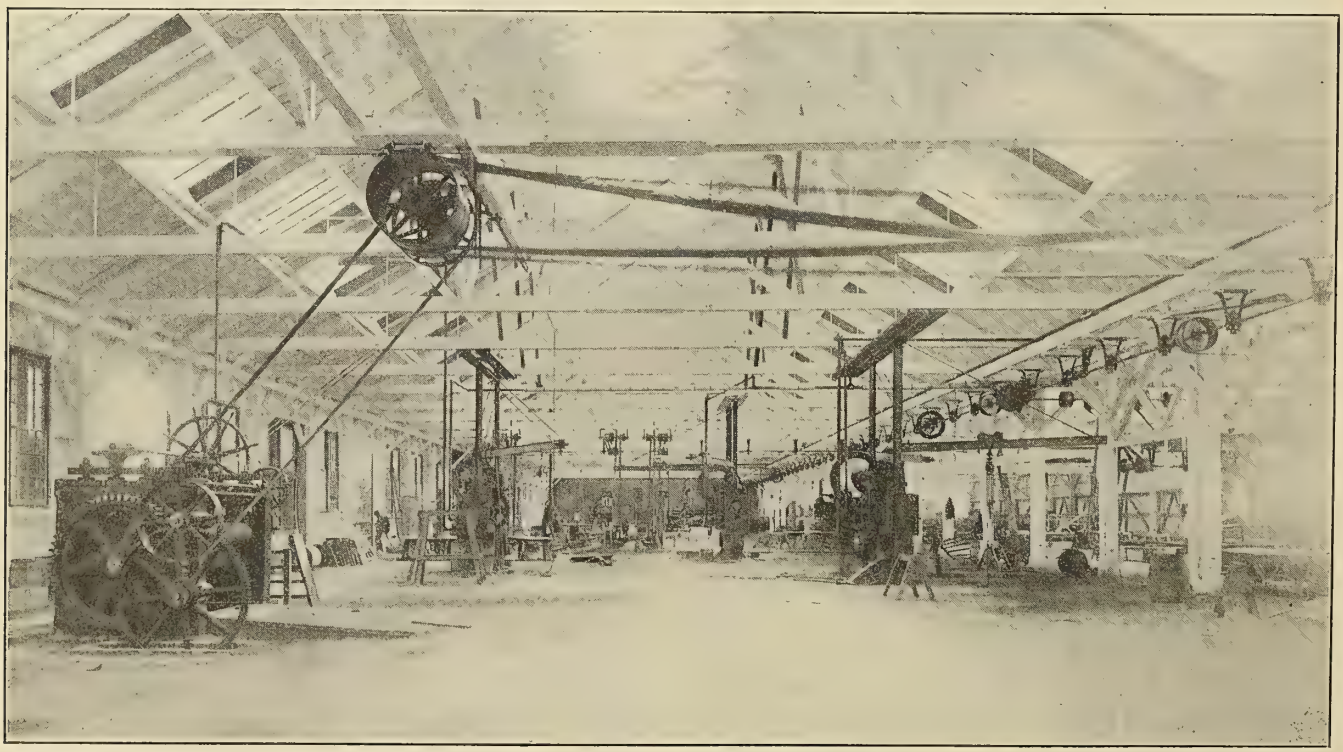


Fig. 3.—Interior of Old Plate and Punch Shed

and a similar crane of 15 tons capacity have been installed by the Alliance Machine Company, Alliance, Ohio. As shown by the photographs, these cranes operate on specially built tracks adjacent to the ways. The material is conveyed to these cranes by a 10-ton crane traveling across the head of the ways.

At present the yard has six building ways. Slip No. 1 is capable of taking vessels up to 350 feet long by 46 feet beam. Slips Nos. 2, 3, 4 and 5 can accommodate ships up to 550 feet long, and, with the exception of slip No. 3, can accommodate ships up to 72 feet beam. Slip No. 3 can accommodate vessels up to 62 feet beam, while slip No. 6 can accommodate vessels 650 feet long by 78 feet beam.

In addition to the changes to the building slips, a large new machine shop and a large ship platers' shed are being erected. The new machine shop will be 425 feet long and 180 feet wide, while the new ship plater's shed will be 600 feet long and 75 feet wide. Between the ship shed and the boundary line of the company's property new storage racks are being erected, to be served by traveling cranes.

Besides hull work, the plant is fully equipped for building boilers, engines, auxiliary machinery, joiner work and fittings, so that practically the entire ship can be built in

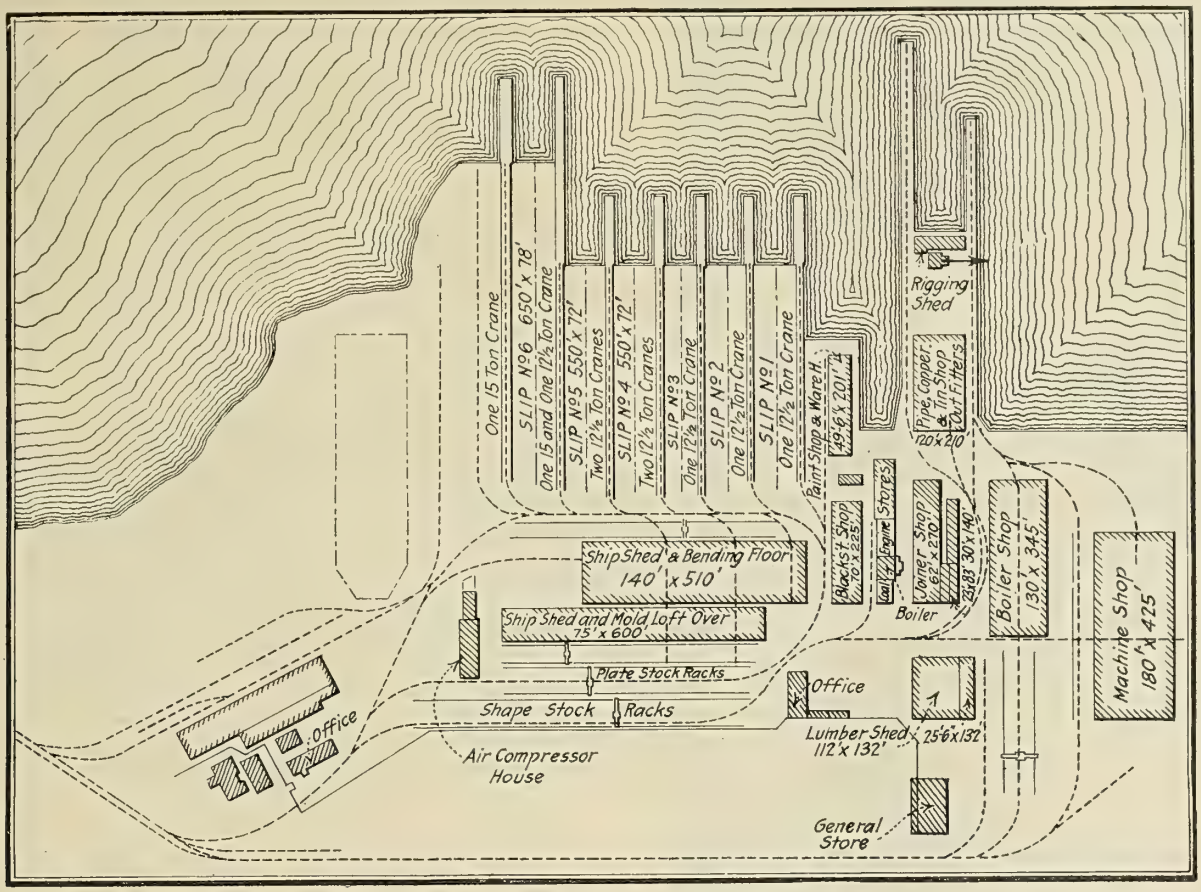


Fig. 4.—General Plan of the Shipyard of the Maryland Steel Company, Sparrows Point, Md.

Fig. 5.—New Electric Tower Cranes

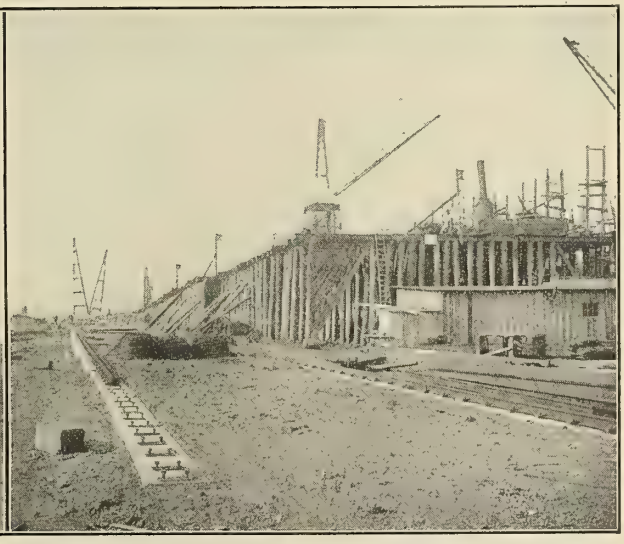
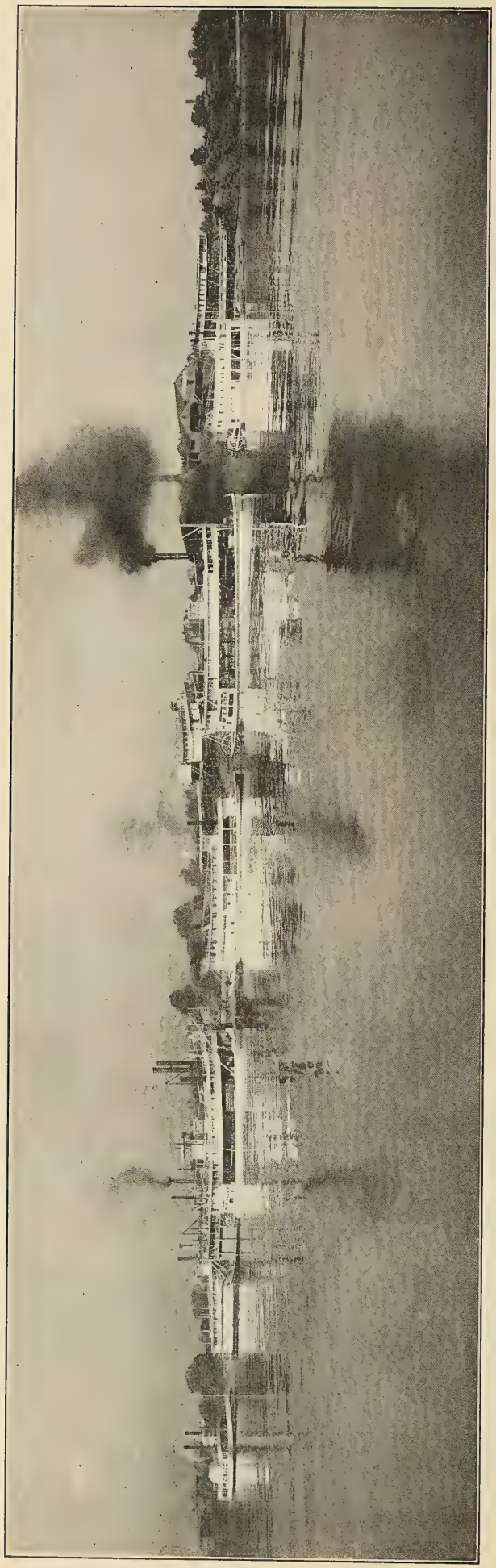


Fig. 6.—New Building Ways



General View of Plant of Howard Ship Yards Company on the Ohio River at Jeffersonville, Ind., Showing Types of River Steamboats Built

the yard. The shops include boiler and machine shops, a blacksmith shop, pattern shop, carpenter and joiner shop, paint shop, coppersmith shop, tinsmith shop and outfitting and rigging shops. The equipment and facilities of the plant are modern and complete in every respect. As a result, the company has been able to establish an enviable record in the rapidity of ship construction.

During recent years all classes of vessels have been built at the yard, including ocean-going passenger ships, freighters, ferry boats, tug boats, barges, yachts, car floats and steam lighters, colliers, torpedo boat destroyers, bay and river steamers, dredges and oil tankers.

Docking Facilities at New Orleans, La.

The New Orleans Dry Dock & Ship Building Company own and operate two new floating dry docks, modern in every respect; one of 5,000 tons capacity and one of 2,000 tons capacity and a full supply of pneumatic tools with full-powered air compressors to operate same. Electric current is supplied to all parts of the docks for light and power. Ample wharf room on the premises is available for vessels while under repair, with no charge for same. Good calkers and carpenters are always on hand with careful supervision of work. Saw and planing mills and blacksmith shops are on the premises.

These dry docks have no interest in any foundry or machine shop; all foundries and machine shops in this vicinity work on these docks. Competitive bids on all classes of machine work can be had from any or all of them, thus insuring reasonable rates.

The United States Navy Department maintains in New Orleans, a first class floating dock of 18,000 tons capacity. This dock, while not competing for commercial work within the capacity of the New Orleans Dry Dock & Ship Building Company's docks, is available for commercial purposes for all vessels beyond the capacity of the New Orleans Dry Dock & Ship Building Company's largest dock, which is 5,000 tons.

Therefore New Orleans stands in the position of being able to take care of any vessel up to 18,000 tons, and as no vessels larger than this have ever entered this port or are in ordinary commercial use in the Gulf, it places New Orleans, as to docking and repairing facilities, in advance of any other port in the Gulf or on the Atlantic Coast, except New York and Newport News.

Shipyards on the Western Rivers

Prominent among the shipyards on the western rivers of the United States where steel and wood light-draft river steamers are built, are the Howard Ship Yards Company, at Jeffersonville, Ind., the James Rees & Sons Company, Pittsburgh, Pa., Charles Barnes & Company, Cincinnati, Ohio, Johnston Bros., Ferrysburg, Mich., and the American Bridge Company, Pittsburgh, Pa. The types of vessels built at these yards include stern and side wheel paddle steamers, screw propeller boats with tunnel sterns, and barges of all descriptions of both steel and wood. On account of the peculiar conditions existing on the large western rivers these vessels are of necessity of light draft, and, where the vessel is for packet service, of comparatively high speed. Recent developments in river boat construction have led in some cases to the adoption of internal combustion engines for the propelling machinery and a general simplification in the design and construction of hull work, so that a modern steel self-propelled barge for the Ohio or Mississippi rivers bears only slight resemblance to the older type of stern wheel steamboat.

The Merrill-Stevens Shipyard, Jacksonville, Fla.

With the general industrial awakening of the South, the art of shipbuilding has not been neglected—even in the far South. Jacksonville, Fla., is the home of a very thriving shipbuilding plant owned by the Merrill-Stevens Shipbuilding Company, which was organized in 1887 and is now under the direct management of its three founders. While this company has been engaged hitherto in marine repair work and dredging and wrecking operations, it has recently acquired property across the St. John's River from its present site for the purpose of establishing a plant for the construction of hulls alone. The equipment for this plant has already been obtained, and the new plant will be opened as soon as the volume of new work warrants it.

Meanwhile the present plant is undergoing a change, from steam drive to electric individual drive. A powerful air compressor plant has already been installed and all the machinery about the yard is gradually being adapted for individual electric drive. As the power is to be supplied by a municipal power plant at a very low rate, it is the plan eventually to eliminate the steam power of the plant entirely and substitute compressed air for operating the steam hammers in the blacksmith shop.

The company is at present engaged in building its eighty-eighth hull. Among the vessels built at the yard are the Clyde steamer *Osceola* and the ferryboat *South Jacksonville*. Some idea of the extent of repair work undertaken by the company is shown by the fact that the steamship *Colorado* of the Mallory Line, which was burned at sea last summer, is being converted into a tramp freighter.

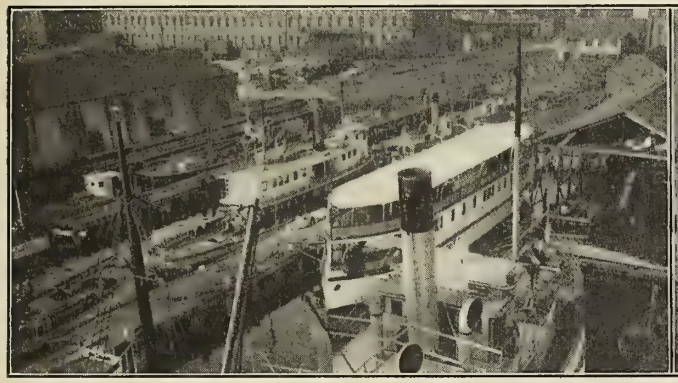


Fig. 1.—Corner of the Merrill-Stevens Plant

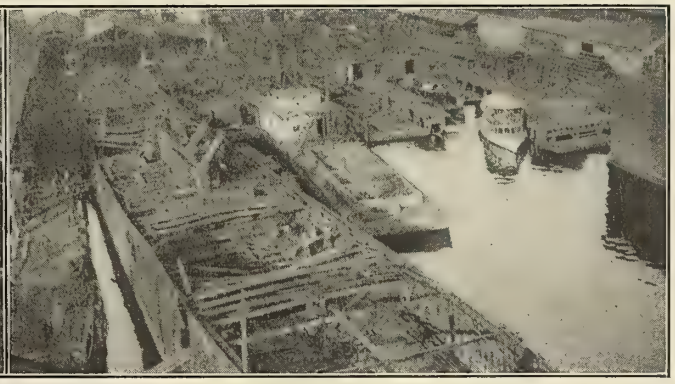


Fig. 2.—Burned Hull of the *Colorado* Being Rebuilt

Fig. 3.—S. S. *Osceola*, Built by the Merrill-Stevens Company

Fig. 4.—Merrill-Stevens Floating Dry Dock

The equipment of the yard consists of the usual machine, blacksmith, boiler, carpenter shops, etc., and there are five dry docks, the largest of which is a floating dry dock of 4,500 tons deadweight capacity. The other docks are of 500, 200, 30 and 15 tons capacity, respectively.

Spedden Shipbuilding Company

Founded by the late Captain R. M. Spedden, the Spedden Shipbuilding Company was incorporated in 1898 for building and repairing ships, engines and boilers. The plant consists of two building berths and a railway dry dock of 1,200 tons capacity, with a length of ways of 200 feet, a machine shop, boiler shop, smith shop, mold loft, pattern and joiner shop and a 600-foot wharf where the depth of water is 20 feet.

The machine shop is 50 feet by 90 feet, equipped with lathes, planers, shapers, drill presses, horizontal and vertical boring mills, milling machines, pipe and bolt cutters, cold saws and other equipment. A traveling crane runs the entire length of the shop, serving the heavy machines and erecting floor. Boom cranes are used for handling work at the light machines.

The boiler shop is 60 feet by 90 feet, equipped with a bull riveter, large and small power punches and shears, large and small steam-driven plate rolls, a plate planer and all classes of air tools. A traveling crane runs the entire length of the shop, while the bull riveter is served by an independent traveling crane. Boom cranes serve the other tools.

The smith shop is 30 feet by 60 feet, equipped with steam hammers, six forges, power press and a full equipment of smith tools. The pattern and joiner shop is 30 feet

by 75 feet equipped with band saws, a planer and jointer. The mold loft covers an area of 90 by 110 feet.

Compressed air is used for drills and hammers and serves the entire plant, including the whole length of the wharf. Water pipes extend the length of the wharf for filling boilers and tanks, after repairs have been executed. Electric lights are installed throughout the plant and wharf.

The yard equipment consists of power punches, shears, plate rolls and a fuel oil furnace, 36 inches wide by 30 feet long, with face plates 25 feet by 35 feet located in front of the furnace. The furnace and all tools are served by boom cranes, while the launching ways, which are 150 feet and 200 feet long, respectively, are served by mast and locomotive cranes. The marine railway is also served by mast cranes.

Spedden Shipbuilding Plant

Valk & Murdock's Marine Railway

At the present time the company is rebuilding a tug boat and a ferry boat, converting a steamer into an ocean-going barge and building a 160-foot tug boat of 1,000 horsepower, a 125-foot tug boat of 600 horsepower, and a gasoline (petrol) driven 60-foot oil barge of 70 horsepower, bringing the total value of work in hand up to about $300,000 (£61,600). Two hundred men are now employed at the yard, but this force will be materially increased upon the arrival of material now on order.

Valk & Murdock Company

The plant of Valk & Murdoch Company, Charleston, S. C., has a water front of 630 feet, and the yard extends back 700 feet from the water front. At the head of the company's wharf, which is 320 feet long by 20 feet wide, there is a depth of water of 30 feet. The equipment includes a boiler shop 200 feet long by 50 feet wide, with a 30-foot wing extending the entire length of the shop, giving a floor space of 200 feet by 80 feet; a machine shop 150 feet long by 50 feet wide; a foundry, 60 feet by 40 feet; a forge shop, 60 feet by 30 feet; a coppersmith shop and two marine railways, one of 1,600 tons capacity, 220 feet long by 55 feet wide, and the other of 200 tons capacity.

The boiler shop is equipped with a 40-ton electric traveling crane in the main building and a 5-ton and a 1-ton traveling crane in the wing. The riveting plant consists of a hydraulic riveter with a gap of 12 feet 6 inches, capable of exerting pressures of 25, 50, 75, 100, 125 and 150 tons. This machine is served by a 25-ton hydraulic crane. The shop equipment also consists of two large radial drills; one drilling and countersinking drill with a 15-foot arm; a heavy punch with a 42-inch gap; also a 36- and a 30-inch gap punch; a plate planer, two horizontal and one vertical rolls, as well as pneumatic riveters and drills supplied with air from four air compressors with a combined capacity of 1,250 cubic feet.

The machine shop is equipped with seven lathes up to 72 inches swing, a large boring mill, two 48-inch radial drills and one upright drill, portable boring bars up to 48 inches capacity, a 36-inch by 12-foot planer, two shapers, one slotter, emery grinders, a portable crane, two bolt cutters up to 3 inches capacity, and pipe cutters up to 6 inches capacity, all being driven by electric motors.

The forge shop contains a steam hammer with crane and four forges. The foundry is of 5 tons capacity, with a steam hydraulic crane, core ovens, brass furnace and two cupolas of 6 tons capacity each. There is also a fireproof pattern storage building, and the company's wharf is equipped with air and water mains extending the full length of the wharf and also around the marine railways. Railway connections extend to the head of the wharf and through the yards, connecting with all the railroads entering the city. A 15-ton Brown traveling crane serves the yard, wharf and railway.

Valk & Murdock Boiler Shop

Chester Shipbuilding Company

The Chester Shipbuilding Company, Chester, Pa., which has acquired the site of the old Roach shipyard in Chester, has entirely refitted the yard with new machinery and equipment for the construction of merchant vessels, and now has under construction six oil-carrying vessels of 5,000 tons gross each for foreign owners and a freighter of 4,000 tons for American ownership. The oil tank steamships are from 400 to 450 feet in length.

As this yard is equipped only for the construction of hulls, contracts for the propelling machinery of all vessels built at the yard are sublet to outside firms.

Baltimore Shipbuilding Plant Reorganized

New Buildings and Machinery for Ship Construction and Repairs Installed by the Baltimore Dry Docks & Shipbuilding Co.

Expenditures of about $200,000 (£41,000) for repairs and improvements have recently been made by the Baltimore Dry Docks & Shipbuilding Company at its plant in Baltimore, and the yard is now engaged to capacity in building and repairing steam vessels. While this plant was established nearly half a century ago as the Columbia Iron Works, and was later known as the Skinner Shipbuilding & Dry Dock Company, it was entirely reorganized a year ago and incorporated under its present name. Since the reorganization new machines have been installed in the old shops, extensive repairs have been made to the dry docks and piers at the two yards operated by the company, and a new steel shop 220 feet long by 60 feet wide has been constructed; also two new building slips with overhead traveling cranes have been completed, giving the company two large slips where vessels can be built economically.

The two plants operated by the company are known as the upper plant and the lower plant. The upper plant is located at the foot of Belt and Cross streets, Baltimore, and includes in its equipment a 600-foot dry dock with a floor width of 62 feet and 22½ feet depth of water over the sill. This dock was completed in 1902 and cost nearly $500,000 (£102,500). There are also two marine railways, a shipbuilding berth, saw mill and various shops and office buildings at this plant.

At the lower plant, located at Locust Point, there is another dry dock, 437 feet long, with a floor width of 50 feet and 22½ feet depth of water over the sill. At this plant are three shipbuilding berths with traveling locomotive cranes, platers and smith shop, a carpenter and joiner shop, mold loft, brass foundry, machine shop, boiler shop, coppersmith shop, pipe shop, paint shop, storerooms, tool rooms, power house and office building.

The company now has contracts for the construction of seven bulk oil tankers for Cristoffer Hannevig, Christiania, Norway, four of the vessels to be equipped with heavy oil engines, and the other three with geared turbines. Each vessel will cost about $500,000 (£102,500). In carrying out this work the company will employ from 1,000 to 1,200 men. In addition, the company is building a seagoing dredge, the *San Pablo,* for the engineer de-

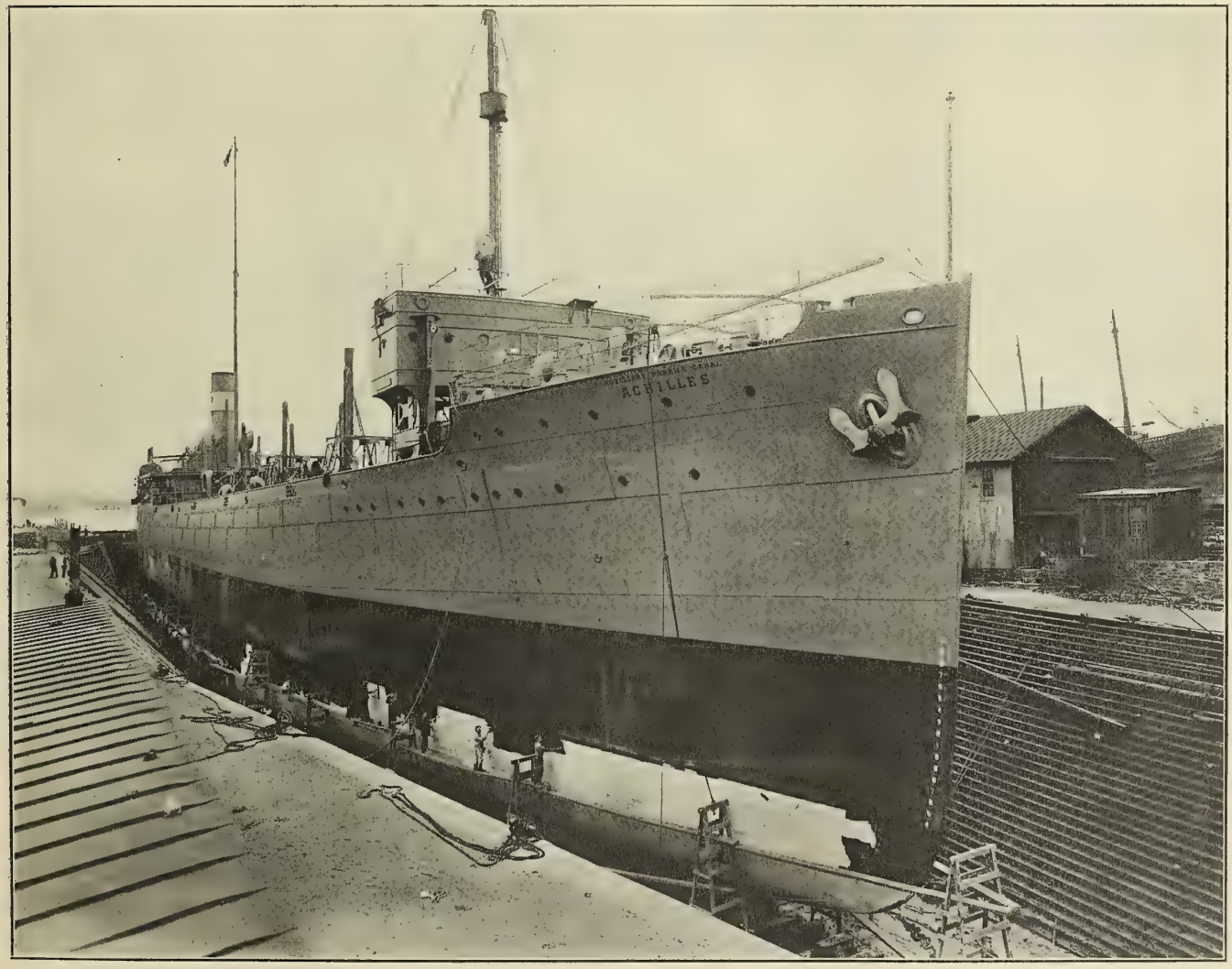


Fig. 1.—Panama Collier *Achilles* Being Cleaned and Painted in the Upper Dock of the Baltimore Dry Docks & Shipbuilding Company

Fig. 2.—Waterfront of Baltimore Dry Docks & Shipbuilding Company's Plant

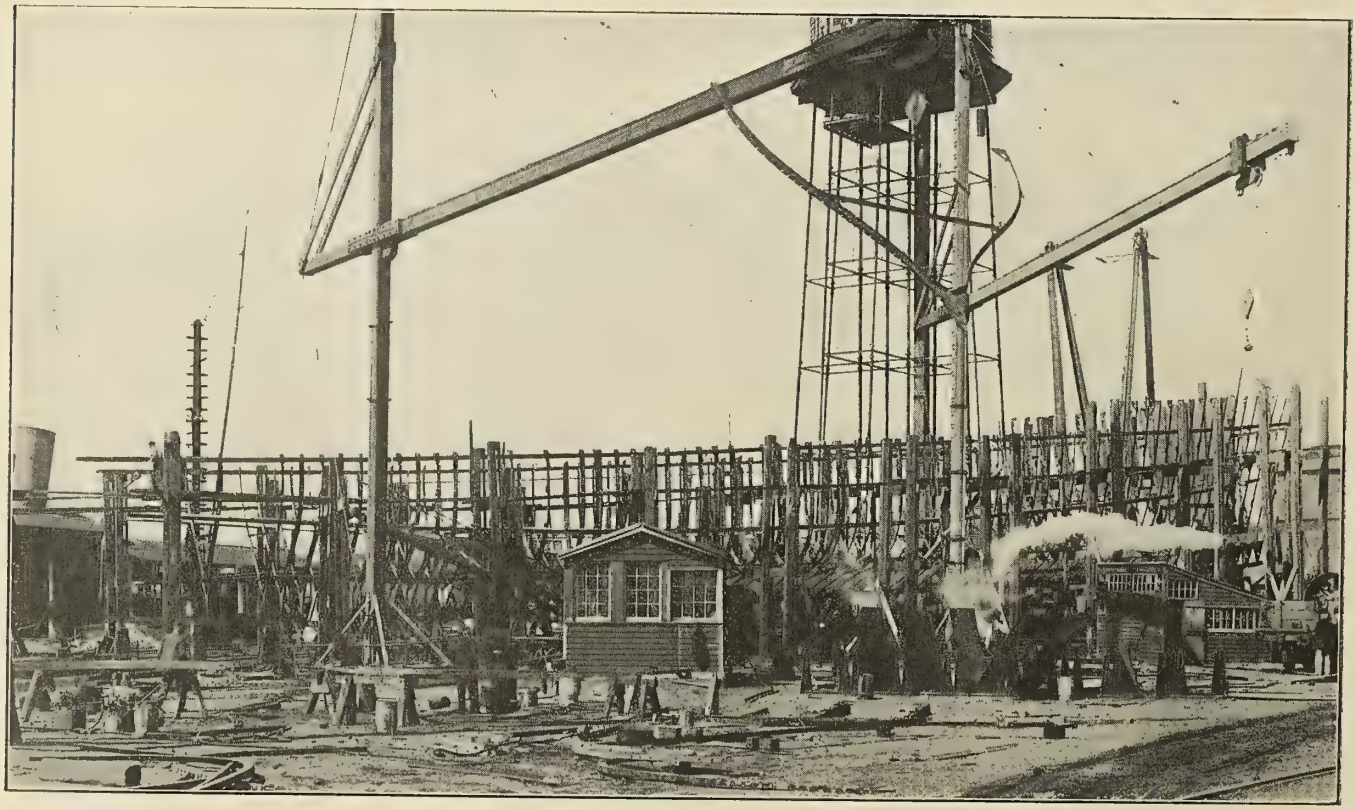
partment of the United States Army. Ninety-five percent of the vessels which ply to Baltimore can be accommodated in the company's largest dry dock, and on account of its location and equipment a large volume of marine repair work is carried out each year. The Panama collier *Achilles* is shown in the 600-foot dock in Fig. 1, while Fig. 2 shows the busy aspect of the yard at present.

Pusey & Jones Shipyard

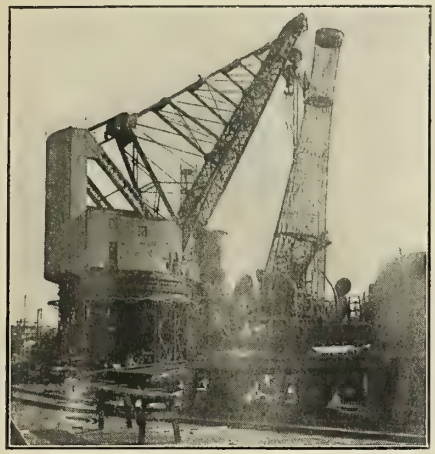
The shipyard of the Pusey & Jones Company is located on the banks of the Christiana at Wilmington, Del., about a mile and a half from the Delaware River. On one side is the Pennsylvania Railroad main line, with spur tracks entering the plant in two lines, one of which comes alongside a landing platform the full length of the storehouse.

There are four shipbuilding ways and a marine railway. Vessels up to 250 feet can be handled, and up to this limit some of the finest yachts in the country have been built. This firm built the first iron sailing ship, the *Mahlon Betts,* and the yacht *Volunteer,* which defended the "America" Cup.

The work at present on hand consists of two lightships for the Bureau of Lighthouses, three derrick barges for the Pennsylvania Railroad, two harbor tugs for the New York Central Railroad, and one harbor tug for the Philadelphia & Reading Railway.



Vessel in Frame at Pusey & Jones Shipyard



Newport News Shipyard and Repair Plant

Marine Work, Valued at Nearly $30,000,000, Now Under Construction by the Newport News Ship= Building and Dry Dock Company

CONVINCING evidence of the revival of shipbuilding in the United States is found in the fact that the Newport News Shipbuilding & Dry Dock Company, Newport News, Va., now has under construction work valued at nearly $30,000,000 (£6,150,000), consisting of nineteen vessels, seventeen of which are merchant vessels, aggregating 128,000 gross tons, and two battleships of 63,400 tons displacement, making in all nineteen vessels of over 191,000 tons, to say nothing of a large amount of repair work, which forms an important part of the company's annual business. The company now has on its pay roll 7,000 employees, as against 4,100 a year ago, and is making expenditures amounting to $400,000 (£82,000) for improving equipment and replacing old machinery and buildings.

That the company has maintained a very large volume of repair business, in addition to its construction work, is shown by the fact that since the plant was started in 1886 between 3,000 and 4,000 vessels have been docked in its three large dry docks. During the year ending December 31, 1915, the number of arrivals at the shipyard piers was 657. The raw material used by the plant each year in-

Fig. 1.—Holland-America Liner *Rotterdam* in Dry Dock No. 2 of Newport News Shipbuilding & Dry Dock Company, Newport News, Va.

cludes in round numbers 55,000 tons of structural steel, including plates, shapes, bars, forgings and sheets; 5,000 tons of iron, steel and copper castings, 38,000 tons of coal, 550,000 gallons of fuel oil and 8,000,000 feet, board measure, of lumber.

The plant now occupies an area of about 125 acres and has a deep-water frontage of about one-half mile. When the plant was started in 1886 a large basin dry dock, known at present as dry dock No. 1, was built, and subsequently shops and other equipment were added, so that at the present time the equipment is thoroughly modern and includes shops and tools capable of undertaking any kind of marine work pertaining to the construction or

Fig. 2.—Shipyard Dispensary

repair of hulls, engines, turbines or boilers. Electric, hydraulic and pneumatic power are used for driving the tools of various kinds, the power being supplied by a central power plant developing about 5,000 horsepower.

In view of the fact that 1915 was the most eventful year in the history of the plant, and that the prospects for the present year are even better, extensive additions have been planned, including the erection of a new machine shop, an administration building, a luncheon room, as well as the replacement of the old boilers in the power plant by watertube boilers with automatic stokers, and the addition of a new craneway with 10-ton cranes for handling plates and shapes. New brick buildings are also to replace some of the old wooden buildings. All of this work has been planned by the company's own engineers and covers practically every department of the yard.

The yard now has seven shipways, six of which are covered by cantilever cranes running on trestles. Across the ends of these ways longitudinal carriers now in course of construction furnish quick conveyance of material to any particular shipway.

There are three basin dry docks now in use, the dimensions being as follows:

	No. 1 Feet	No. 2 Feet	No. 3 Feet
Length over all.....	639	861	585
Width at top of dock.....	130	162	147
Depth of water over sill.....	25	30	24

The largest fitting-up basin is 764 feet by 250 feet between piers Nos. 2 and 3, and on the pier, forming one side of this basin, is a 150-ton revolving crane. The smaller fitting-out basins are provided with shear legs or fixed derricks, and, in addition, floating derricks are available for installing heavy weights on ships afloat.

The machine shop, an interior view of which is shown in Fig. 4, is approximately 560 feet long by 101 feet wide. In the last few years special machinery, much of it designed and built in the works of the company, has been installed for the rapid and economical construction of turbines.

The ship shed, framing shed and kindred departments are grouped adjacent to the building slips. The machine, boiler, blacksmith, copper and outfitting shops form another group, while the joiner and pattern shops, lumber shops, fireproofing plant and saw mill are all near each other. The framing shed, located at the head of the slips, is 270 feet by 344 feet, and at each side of the framing shed is a ship shed served by a cantilever crane, which can transport fabricated material to points where it can be picked up by the cantilevers serving the building slips. The ship sheds are 320 feet by 60 feet and 400 feet by 72 feet, respectively.

In addition to the operations at the shipbuilding plant, the company operates two large foundries, one for steel and iron castings and the other for brass work. These foundries are located near the shipyard and are connected directly to it by railroad tracks.

Work for the welfare of the employees has claimed the most earnest consideration of the management of the yard. It is believed that the colored Y. M. C. A., recently organized at the yard, is the first of its kind in any industrial plant in this country, and the results of this work have been most gratifying, especially in the item of regular and constant attendance on the part of the colored employees. On January 1, 1915, the company announced a

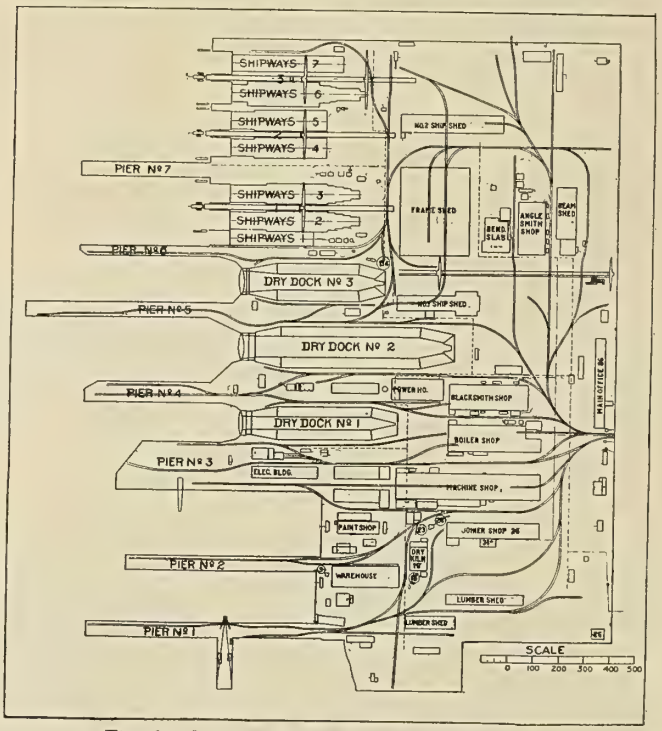


Fig. 3.—Layout of the Newport News Yard

plan for retirement allowances for its employees who have reached retirement ages, and a number of employees are now receiving such allowances. The company has also just finished the construction of a dispensary inside the plant, where a surgeon and nurse are in constant attendance, so that immediate attention can be given to any cases of accident or sudden illness.

The keel of the first vessel constructed at this yard was laid down in June, 1890. Since that time the yard has constructed 182 vessels of all classes, and, as stated above, now has under construction no less than nineteen vessels, including two superdreadnoughts for the United States Navy, eight large oil-tank steamships, eight freight steam-

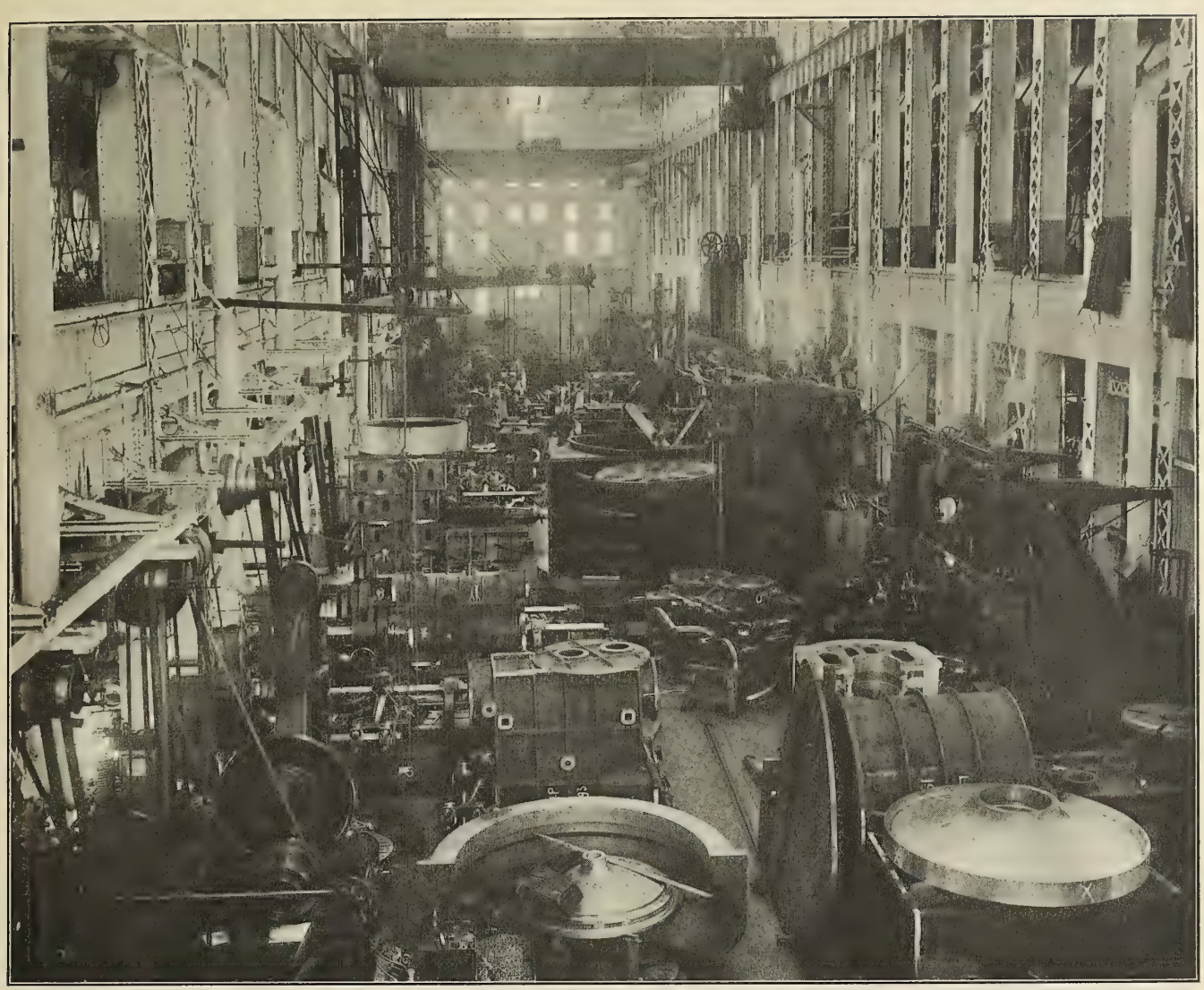


Fig. 4.—Interior of Newport News Machine Shop

ers and a passenger and freight steamer. Only once in the history of the plant has the volume of construction now in hand been exceeded; that was in 1905, when the company was building six warships for the Government. As far as merchant-vessel construction is concerned, the production of 1915 has never been equaled, and the output for 1916 will be still larger. It is a significant fact that, whereas in the past naval construction has constituted from 75 to 80 percent of the output of the yard, at the present time nearly 67 percent consists of merchant vessels, and all of these are for the American merchant marine.

Toledo Shipbuilding Company

That shipbuilding on the Great Lakes is no longer confined to the construction of lake vessels only, is shown by the fact that at the plant of the Toledo Shipbuilding Company, Toledo, Ohio, eleven vessels are under contract, six of which are for the Atlantic coast trade, four for Norwegian trade and one for the Great Lakes.

This plant is located on the Maumee river, six miles from Lake Erie, with a 23-foot channel to the coal and ore docks above the yard. The plant covers 20 acres and has three building berths and two dry docks. Two of the building berths are 550 feet long and one 650 feet long. One of the dry docks is 550 feet long by 100 feet wide, and the other 650 feet long by 100 feet wide with 16 feet of water over the sill. Gantry cranes of 10 tons capacity serve each of the building berths and extend 32 feet over each dry dock, running the full length of the dock.

The yard is complete with departments for building and repairing all types of vessels, machinery, boilers, auxiliary machinery, electrical machinery and lighting plants, steam fitting, piping, plumbing, rigging, joiner and carpenter work, etc. The yard has a capacity of producing about 25,000 gross tons of shipping per year and employs from 800 to 1,200 men.

The equipment of the yard includes a 100-ton shear leg located on the dock front for hoisting machinery, boilers, etc., and four 10-ton jib cranes located at the dry docks and slip. The slip is large enough to berth four vessels.

Vessels Built in the United States in January.—According to reports from the Bureau of Navigation, Department of Commerce, 48 vessels of 26,408 gross tons were built in the United States and officially numbered during the month of January. Six of these vessels of 21,373 gross tons were steel steamships. The largest vessel built during the month was the *Santa Barbara,* built by the William Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa., for the Atlantic & Pacific Corporation.

Fig. 1.—Electric Tower Cranes at Harlan & Hollingworth Shipyard

The Harlan & Hollingsworth Corporation

Shipbuilding and Repair Yard that Forms an Important Subsidiary of the Bethlehem Steel Corporation

At the plant of the Harlan & Hollingsworth Corporation, located on the Christiana River, at Wilmington, Del., fourteen vessels of about 85,000 tons deadweight, valued at about $10,000,000 (£2,050,000), are under construction, furnishing employment to about 2,000 men. Never in the experience of the company have the prospects for shipbuilding been better. Their repair and drydock work is normal for the port, and there is every prospect of a continuation of inquiries for new construction.

The Harlan & Hollingsworth shipyard dates back to the pioneer days of iron and steel shipbuilding, having built in 1843 the first iron seagoing, single-screw steamship to be built in the United States. This was the *Bangor,* of 450 gross tons. Since that time over 450 vessels of various types have been built at the yard. Since 1905, when the plant, together with the Union Iron Works, of San Francisco, and the Bethlehem Steel Company, of South Bethlehem, Pa., became subsidiaries of the Bethlehem Steel Corporation, the yard has been entirely rebuilt and reorganized. The building ways were rebuilt, making in all five launching ways capable of accommodating vessels up to 520 feet in length.

In connection with the building slips, nine electrically operated tower cranes of 5 tons capacity, with a radius of 90 feet, were installed by the Terry & Tench Company, Inc., New York. In these cranes the main fall is in two parts and the boom fall is in seven parts. The drum speed of the hoist machines is 200 feet per minute. The drums are operated by a 75-horsepower, 220-volt, direct-current motor. Rotation is effected by means of a swinging gear driven by the main hoisting motor operating a pinion, engaging a fixed external gear attached to the top of the tower. The speed of rotation is about one complete circle in a little less than one minute.

Seven of these cranes were installed in 1914, while the remaining two have only recently been installed. The machinery design in the two cranes recently installed is somewhat different from that in the others. The two-drum hoist is operated by a direct-current motor, as in those already described, but rotation is effected by means of a 20-horsepower, direct-current motor independent of the hoisting motor, which drives through a pair of bevel gears a vertical shaft, on the lower end of which is a pinion, which engages the fixed gear already mentioned. This rotating gear is very powerful and quick, and

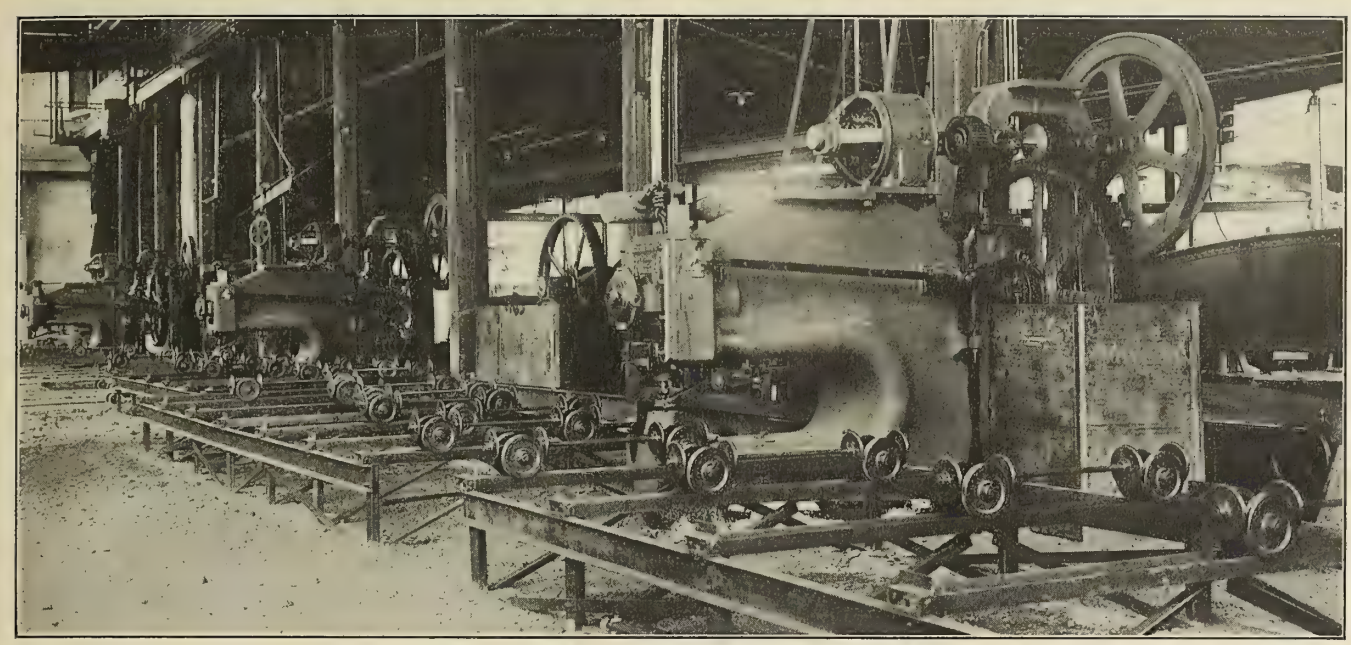


Fig. 2.—Section of the Plate Shed, Showing Punches

is a marked improvement over the first installation.

The hoisting platform is placed high enough to allow it to swing over the ships or their staging. This fixes the height of the tower which supports the mast. The cranes near the water have a tower 55 feet high. The towers amidships are 62 feet high, while those at the bow of the

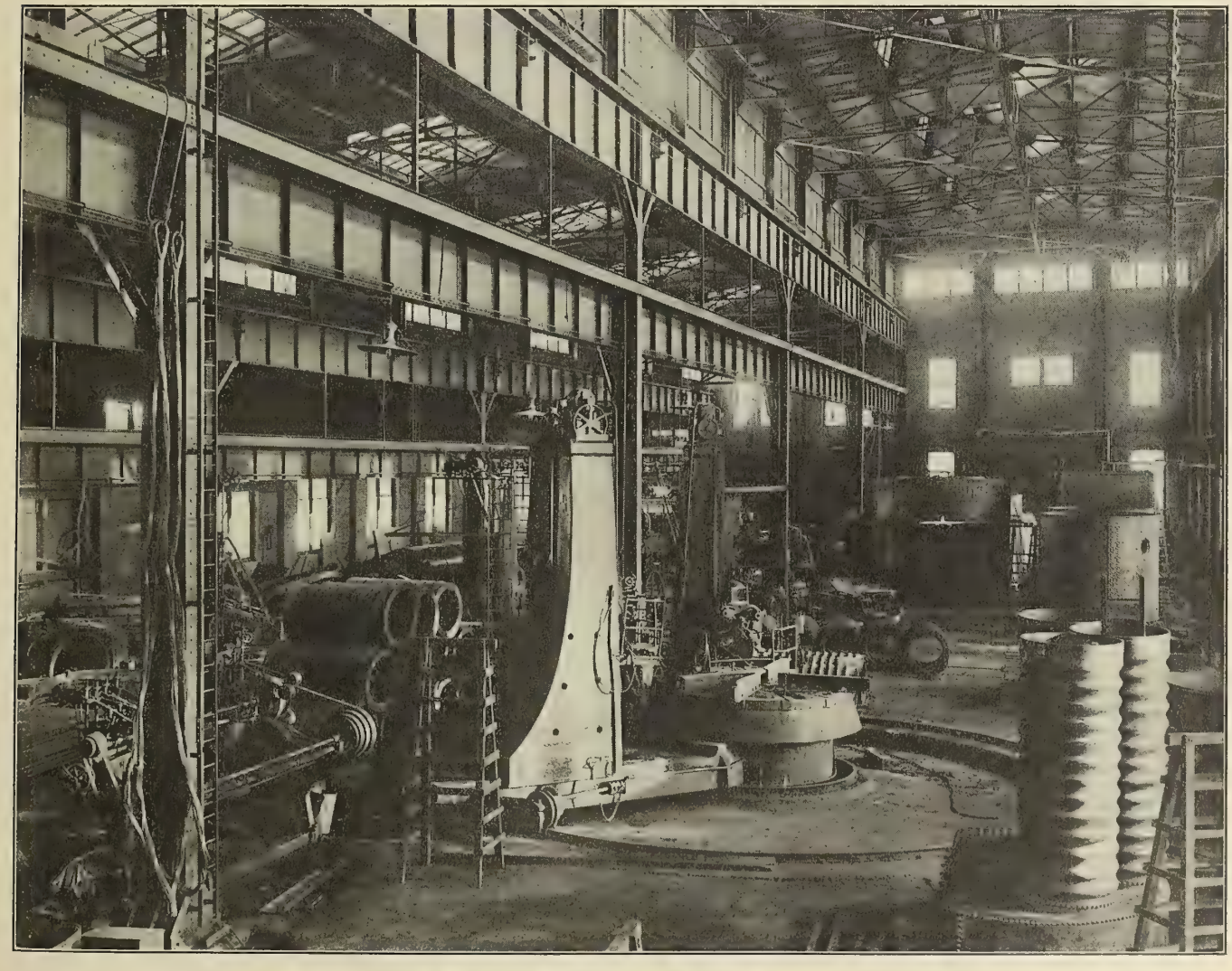


Fig. 3.—Interior of the Boiler Shop, Showing Special Shell Drilling Machine

ship extend up to a total height over all of 72 feet.

The yard is equpped with a basin dry dock large enough to dock vessels up to 345 feet in length, drawing 13 feet of water or less.

An important feature of the plant is a splendidly equipped boiler shop 300 feet long by 124 feet wide. The shop is equipped with electric traveling cranes, and all the machinery is electrically driven. The equipment includes several machines of special design built by the Bethlehem Steel Works, including both horizontal and vertical bending rolls and a boiler shell drill with three heads, each being equipped with four spindles.

Electric current for the entire plant is generated in a central power house by two Macintosh & Seymour cross compound, vertical, condensing engines, directly connected to General Electric generators. The main engines are used for day service, while for night service there is also a 15-kilowatt marine type generating set and a 150-horsepower Curtis turbine connected to two General Electric generators. Compressed air for the yard is furnished by Franklin air compressors, and pressure for the hydraulic machines and tools is furnished by a Worthington pump.

The output of the yard embraces every style of vessel from small pleasure launches to the largest and swiftest steam yachts, river and harbor steam and ferry boats, large passenger and freight ships for coastwise service, sound and bay passenger and freight steamers, such as the *Virginia, Manhattan* and *Narragansett,* coastwise lumber steamships, of which the *Columbia, John A. Hooper* and *Francis Hanify* are examples, as well as large ocean-going oil tank steamships, several of which are now under construction.

Morse Dry Dock & Repair Company

Plans have been completed and the preliminary work is well under way for practically the complete reconstruction of the large marine repair plant of the Morse Dry Dock & Repair Company, Brooklyn, N. Y. The entire plant covers 20 acres and extends 1,900 feet out into the harbor. The new buildings to be erected include a three-story and basement, steel and concrete office and storage building 240 feet long by 65 feet wide. It will contain on the ground floor a storeroom for ship fittings and supplies, including all kinds of marine brass goods, while the second floor will contain the general offices, and the third floor offices, luncheon rooms and other departments of the plant. It is also proposed to build a sectional wooden floating dry dock of 30,000 tons capacity capable of accommodating vessels up to 750 feet in length. The pumping equipment on the dock will be electrically driven, of sufficient capacity to lift the dock in twenty minutes.

The Morse Dry Dock & Repair Plant, as it Will Look When Improvements Are Completed

The present floating dry dock operated by the company has a capacity of 15,000 tons. This was built fifteen years ago and is one of the first docks of its type to be constructed. The old dock is equipped with electrically driven, centrifugal pumps, and can be lowered in 7 minutes and pumped up in 35 minutes.

The machine shop is 475 feet long and 85 feet wide, but will be enlarged by increasing its length 200 feet. A new boiler shop 200 feet by 80 feet will also be built, as well as a two-story carpenter and joiner shop 200 feet by 50 feet, and a coppersmith and plumbing shop 150 feet by 50 feet. An important part of the equipment of the plant is an oxy-acetylene plant supplied by the Superior Oxygen Company, Pittsburg. Gas torches are used for cutting metal, while an electric welding plant is available for welding.

The company's piers extend out into the harbor 1,500 feet and there is a depth of water alongside the piers of from 25 to 35 feet. Although the Bush Terminal Railroad runs by the plant, all material is lightered to the yard, as this method of transportation has been found cheaper than by rail.

Robins Dry Dock & Repair Plant

Equipment and Improvements at One of the Largest Ship Repair Plants in the United States

The plant of the Robins Dry Dock & Repair Company, located at Erie Basin, Brooklyn, N. Y., is one of the largest and most completely equipped yards for the exclusive repair of ships in the United States, if not in the world. The plant covers about 30 acres and has a water frontage of over 3,000 feet, which does not include pier measurements.

There are five large dry docks as follows:

No. 1—Graving, 510 feet long, 115 feet wide, 26 feet deep.
No. 2—Graving, 620 feet long, 111 feet wide, 30 feet deep.
No. 3—Sectional, 370 feet long, 110 feet wide, 12 feet deep.
No. 4—Sectional, 560 feet long, 127 feet wide, 17½ feet deep.
No. 5—Sectional, 370 feet long, 101 feet wide, 12 feet deep.

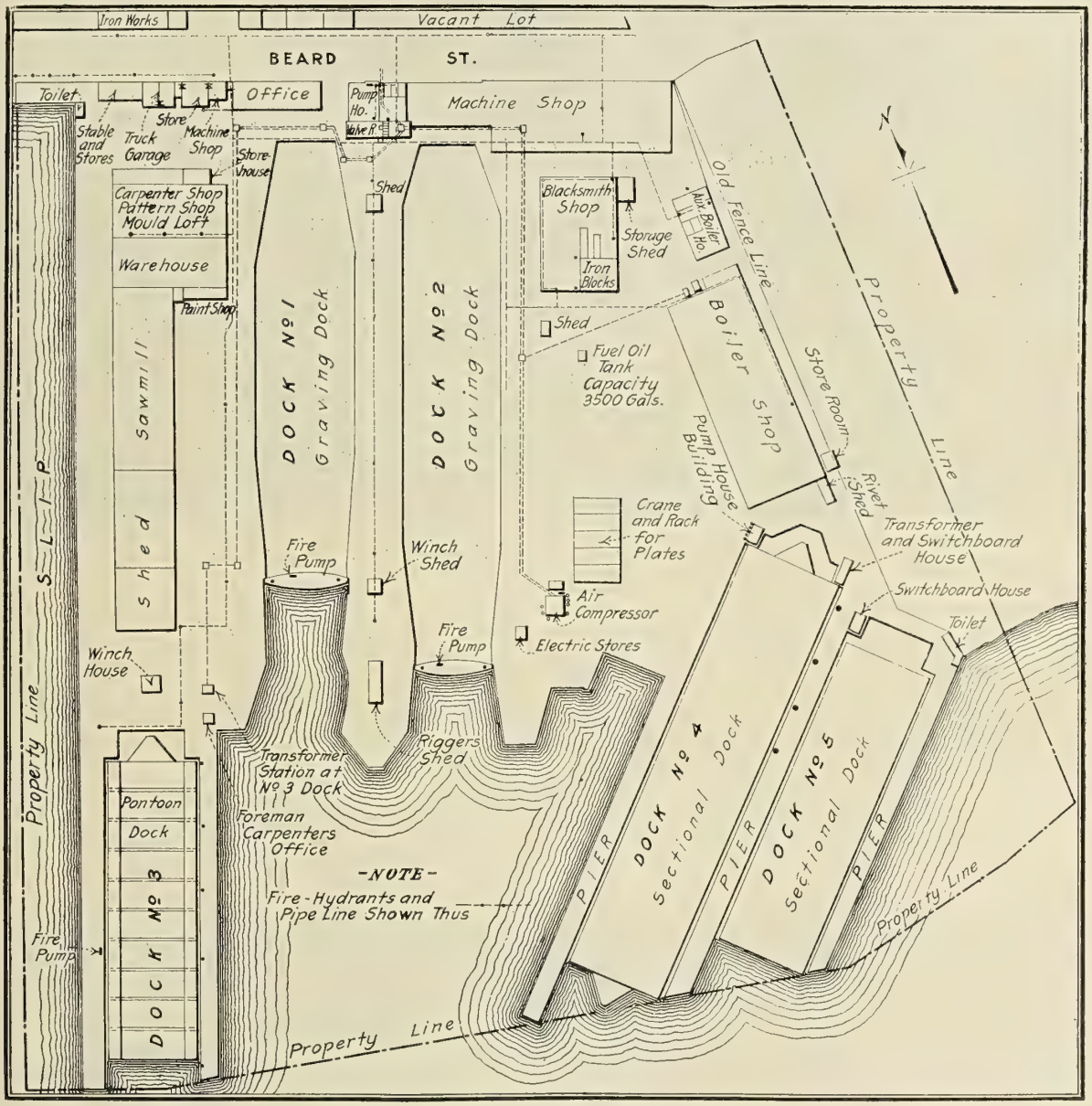


Fig. 1.—Plan of the Robins Dry Dock & Repair Plant at Erie Basin, Brooklyn, N. Y.

Plans are being prepared and options on the material have already been received for increasing the size of one of the graving docks to a length of 1,100 feet and a width of 110 feet with a depth of water over the sill of 32 feet.

Within the last seven years vast improvements have been made in this plant. The plant has been fitted through-

Fig. 2.—Cunard Liner *Carpathia* in Dry Dock No. 4 at the Robins Plant

out for electric drive, which includes the running of all shop tools by motors, as well as the new electrically driven centrifugal pumping system which drains the No. 1 and No. 2 graving docks.

Within this time there has been built a 6,000-ton steel wing floating dry dock, which has ten wood pontoons all arranged to disconnect from the wings if necessary. This dock is operated by two 300-horsepower motors, one on each wing, which drives the line shaft connected to pump shafting, each section having its independent pumps. This dock has been fully described in the August (1909) issue of Marine Engineering.

The new 24,000-ton floating dry dock, which has now been in operation for about two years, is 560 feet long, 127 feet wide, and 17 feet 6 inches depth of pontoons, the wings being 32 feet high above deck of pontoons. The dock is built in six sections, the end sections having 30-foot outriggers.

Owing to the disposition of the dry docks and piers before this dock was ordered, it was found necessary to rearrange the location of their present floating docks, as well as to make extensive changes, which involved a large amount of work. The 6,000-ton steel-winged pontoon dock was shifted to the opposite side of the yard, which required considerable dredging, the removal of one pier and the building of a new pier 21 feet wide, 384 feet long. The old 6,000-ton sectional dock had to be removed and entirely reconstructed by dispensing with the balance floats and upper structure and the building of new wings on sections, also the electrification of same. The 4,000-ton balanced dock was dispensed with, and besides the dredging for the new dry dock, which required nearly 50 feet of depth at low water, three long piers and a large pier platform were built, to which the new dock and the reconstructed dock are anchored.

Within the last year the company has built a large modern machine shop 310 feet long and 80 feet wide, with mezzanine floor. This new shop was built over the old one, and all changes to tools were made and the old shop demolished without losing a day's work. The new shop is built of steel on pile and concrete foundations, and the entire structure is constructed of steel framing concrete walls with large window area for light and ventilation. There are two 20-ton electrically operated traveling cranes installed, which operate the full length of shop, besides the industrial railway. New electrically driven machinery was installed of all types at an outlay of over $100,000 (£20,500), and all the old large tools were arranged with electric drive.

A new Ingersoll Rand air compressor of about 2,500 cubic feet capacity, electrically driven, was recently installed, also a new generator switchboard, etc.

The company is at present erecting a new blacksmith shop, which will also enclose the bending blocks, furnaces and flange fires. The building will be of concrete and steel construction and furnished with additional hammers,

forges, cranes, etc., to make it up to date in every respect.

New oil-burning plate and angle furnaces have recently been installed, and the company is now at work on the building of a modern brass foundry and galvanizing plant. The work of laying concrete paving throughout the entire yard is now under way, considerable of this work having already been completed and a complete industrial railway system has been built extending to all parts of the yard and shops.

Due to the removal of the old machine shop, which also contained the pipe shop, coppersmith and tinsmith shop, a new shop was erected to accommodate these departments with new machinery, tools, etc., complete, and the saw mill was enlarged by the addition of independent motor-driven tools.

In addition to the above shops, the facilities of the plant for making repairs consist of a boiler and plate shop, carpenter shop, joiner shop, pattern shop and mold loft. All the work on ships, such as chipping, calking, riveting, etc., is done with the use of pneumatic tools operated by an air compressor plant of three large electrically driven Ingersoll Rand machines. There is also a complete acetylene gas-burning outfit.

The floating equipment consists of a large twin-screw floating derrick, a steam launch, power launch, to which will be added in the near future a floating compressor plant and electric welding outfit.

Some of the jobs which have been completed at this yard are reconstruction of the American liner *New York,* the rebuilding of the steamers *Monteagle, Lansing, Chr. Knudsen, Massachusetts, Commonwealth, Plymouth, Jose, Antillian, Admiral Sebree, Admiral Clarke;* reboilering of the *Esperanza* and *Monterey* and the conversion of the steamer *Mills* from a freighter to a floating factory for the production of fish oil and fertilizer. The Clyde Line steamer *Iroquois* and the steamship *Howard,* of the Merchants' and Miners' Transportation Company, have been cut and each lengthened 40 feet, the latter job being a record for speed and workmanship for work of this class. A number of oil barges have also been lengthened, as well as the steamboat *New York,* of the Albany Day Line.

The following vessels were built at this yard: The steam yachts *Aloha, Felecia, Seminole, Hauoli* and *Marrietta,* a tug for the Clyde Steamship Company, and a number of steel whaleback barges; also the United States gunboat *Scorpion,* formerly the steamship *Sovereign,* and the steam yacht *Nokomis.*

Among the contracts which the company now has on hand are the steamships *L. V. Stoddard, George Hawley* and the steamship *Geo. E. Warren,* of the Boston Virginia Transportation Company, which will be lengtehened 52 feet, besides being converted into bulk oil carriers and arranged for the burning of oil fuel; the conversion of the steamships *Kroonland* and *Finland,* of the International Mercantile Marine Company to oil burners, and other repair jobs of all descriptions.

Ship Repair Yards in New York Harbor

Dry Docks Available for Vessels of Every Size and Description — A Thriving Industry at America's Greatest Port

On account of the large amount of shipping clearing from the port of New York, New York harbor has become the home of some of the largest and best equipped dry dock and repair plants in the world. Two of these, the Robins Dry Dock & Repair Company and the Morse Dry Dock & Repair Company, are described in the foregoing pages, while below are given the main particulars of the other leading repair plants in this harbor.

Work is carried on day and night at the busiest of these plants. Craft of every description are cared for and extensive equipment for both metal and wood working is required.

One of the largest repair yards in New York harbor is the Tietjen & Lang Dry Dock Company, Hoboken, N. J., which has nine dry docks capable of docking vessels from 500 to 10,000 tons. The capacities of the docks are as follows: No. 1, 500 tons; No. 2, 2,000 tons; No. 3, 800 tons; No. 4, 1,000 tons; No. 5, 1,800 tons; No. 6, 10,000 tons; No. 7, 1,000 tons; No. 8, 800 tons; No. 9, 5,000 tons.

The company employs 2,000 men and handles work valued at about $2,500,000 (£512,500) each year. The plant covers an area of 25 acres, and in addition to the nine dry docks has eight piers for mooring vessels. Its plate shop is one of the largest of the kind in New York harbor. In addition, there are a sawmill and joiner shop, a blacksmith shop, a machine shop, boiler shop and paint shop, besides a storage yard containing the largest stock of lumber of any repair plant in the harbor.

The repair plant of James Shewan & Sons, Inc., in South Brooklyn, N. Y., has seven dry docks. Six of them

Fig. 1.—Plate and Boiler Shop at the Plant of James Shewan & Sons, Inc.

are of wood of the following capacities: No. 1, 700 tons; No. 2, 2,800 tons; No. 3, 3,500 tons; No. 4, 2,500 tons; No. 5, 5,500 tons and No. 6, 6,600 tons. Dock No. 7 is a steel floating dry dock of 12,000 tons capacity, which was built in England and was formerly owned by the government.

The company handles repairs of any kind in wood, iron and steel, and they are able to take vessels at any tide and any time of the day or night. The company is exceptionally busy and does a large share of the repairing to ocean-going craft as well as coastwise and harbor craft. On account of the exceptional amount of business handled during the past year, extensive improvements have been made in the plant, costing about $100,000 (£20,500).

The Union Dry Dock & Repair Company, Weehawken, has a plant fully equipped for repairing wood and iron vessels. The equipment includes one large sectional dry dock and two smaller docks.

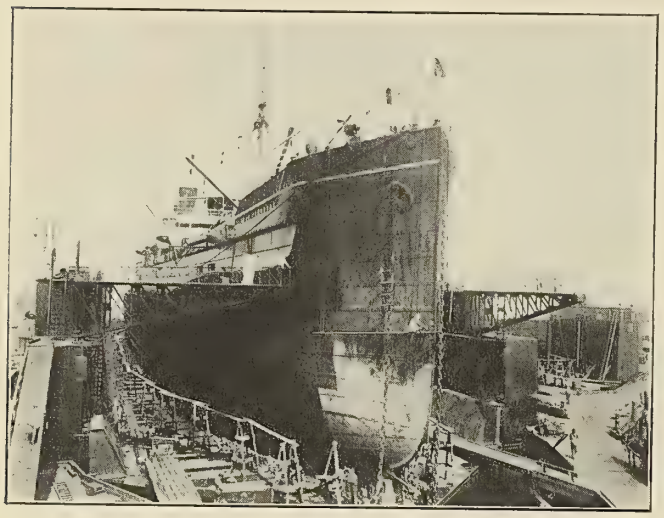


Fig. 2.—Dry Dock No. 7 at the Shewan Yard

The Grimes Engineering Company and Vulcan Iron Works, Inc., Jersey City, N. J., is not only equipped for ship repair work, having four dry docks, two of which are capable of handling vessels up to 2,000 tons, and two of 1,000 tons capacity, but also builds machinery and manufactures several marine specialties, including the Martin-Freeman compensating davit, and special dredging machinery. The shops are fully equipped for machine and blacksmith work. There is also a coppersmith and tinsmith shop and an extensive electric welding plant.

The Perth Amboy Dry Dock Company, Perth Amboy, N. J., shipwrights, calkers, machinists and boiler makers, has four balanced dry docks of 2,500, 2,000, 1,000 and 500 tons capacity, respectively, and a 25-ton derrick with ample pier room for mooring vessels for repairs. While most of the work at this yard is repair work, lighters or floats, barges and other harbor craft are built at the yard.

On Staten Island, aside from the shipbuilding and repair plant of the Staten Island Shipbuilding Company, which is described elsewhere in this issue, there are a number of shipbuilding and repair yards engaged principally in the building or repairing of wooden vessels.

The plant of Verdon & Co., West Brighton, Staten Island, is equipped with two floating docks of 1,600 and 800 tons respectively, where wooden vessels are repaired.

F. McWilliams Dry Dock Company has three floating docks capable of handling vessels from 600 to 2,000 tons. Although the yard is engaged principally in work on wooden vessels, it is gradually being equipped for work on steel vessels.

Three dry docks are available at the plant of Theodore Crane & Co. The capacities of the docks are: No. 1, 1,600 tons; No. 2, 5,400 tons, and No. 3, 9,000 tons. The plant is equipped for repairing both steel and wooden vessels and for building wooden harbor craft.

Three dry docks are also available at the plant of James Tregarthen & Sons Company of 1,000, 2,000 and 3,000 tons capacity, respectively, which are used only for work on the wooden hulls.

The Raritan Dry Dock Company, Raritan, N. J., builds and repairs wooden vessels and is also equipped for building boilers and engines. The docking facilities at this plant include three floating dry docks of 500 tons, 1,500 and 4,500 tons capacity, respectively.

Fig. 3.—One of the Machine Shops at the Shewan Plant

At the Brown Shipyard in Tottenville, Staten Island, two wooden vessels are in frame and one tug is nearing completion. At the Harry Cossey shipyard in Tottenville several wooden barges are under construction.

Manitowoc Shipbuilding & Dry Dock Company

The equipment of the Manitowoc Shipbuilding & Dry Dock Company, Manitowoc, Wis., is diversified to such an extent that the company can undertake a wide range of work. It has a completely equipped machine shop and carpenter shop, a building for laying out plans for complete vessels and for making templates by which steel plates are cut and punched, an electrical shop, pipe shop, tin shop and one of the largest and most completely equipped boiler shops in the Middle West. These facilities combined enable the Manitowoc company to design and construct steel passenger boats, steel freighters, sand suckers, dredges, lighters, fire boats, tugs, dump scows, marine engines, boilers, and other marine equipment.

This shipbuilding company now has under construction one steel survey vessel for the United States Government which will operate in Alaskan waters, a steel fire boat, the *Clevelander,* for the city of Cleveland, and three steel trawlers which are to operate on the Atlantic Coast. The Manitowoc yards are exceedingly busy on reconstruction and general repair work. For this class of work the yards are well equipped, as they have three dry docks, one of them being of steel construction and of sufficient size to accommodate lake freighters.

A short time ago the Manitowoc Shipbuilding & Dry Dock Company put up a large office building which is two stories high, and which is conveniently arranged and tastefully furnished. The lighting system throughout the office is of the indirect type. The buildings of this yard have been increased during the past few months by several extensive additions to the large plate shops and other equipment.

The American Shipbuilding Company

Facilities for Building or Repairing Ships at the Ten Plants Owned or Controlled by the American Shipbuilding Company

Owing to the unfavorable conditions prevailing in the shipping and shipbuilding industry on the Great Lakes during the past year, the American Shipbuilding Company, Cleveland, Ohio, which owns or controls no less than ten separate plants for building and repairing ships on the Great Lakes, and which has frequently ranked among the three or four largest producers of vessel tonnage in the world, experienced the lowest volume of business in its history in 1915. As present conditions indicate, however, the profitable employment of all bulk carriers on the Great Lakes during the coming season, and as there is a considerable influx of orders for ships for seagoing trade, there is every indication that the various yards of the American Shipbuilding Company will be profitably employed during 1916.

New Dry Dock at South Chicago

To meet the necessity of dry-dock facilities commensurate with the steadily increasing large tonnage trading at Lake Michigan ports, the company has constructed at South Chicago a dry dock 700 feet long and 103 feet wide, with a depth of water over the sill of 16 feet. The North Chicago plant of this company has been dismantled, the equipment being moved to the South Chicago plant. From the standpoint of the trade, the dispensing of this dry dock is more than compensated for by the additional dry dock and improved facilities at South Chicago.

The Chicago plant, which covers 23½ acres at 101st street and Calumet River, one mile from the harbor entrance, has three building berths, two 450 feet and one 600 feet long, and two dry docks, one a concrete dock 700 feet long over all, and the other a wooden dock 564 feet long over all. The equipment includes fully equipped punch and machine shops.

Cleveland Plants Centralized

For reasons of economy the company's Cleveland plants are being centralized on property adjoining the dry docks and shipyards at the foot of West Fifty-fourth street, where buildings for the general office and engineering department, the machine shop, foundry and pattern shop are under construction. The Cleveland plant covers 8 acres fronting 250 feet on Cuyahoga River bed, about one-half mile from the main river. There are two building berths aggregating 620 feet in length adjoining a fully equipped punch shop, and three dry docks of the following dimensions:

	Length Overall	Width at Gate
No. 1	552 feet	65 feet
No. 2	450 feet	48 feet
No. 3	350 feet	50 feet

The shops at this plant include a machine shop 100 feet by 120 feet, a foundry building 108 feet by 120 feet equipped with three cupolas, with a capacity of 18 tons per hour, and a complete brass foundry. There is also a pattern shop and pattern storage building 100 feet by 200 feet and a boiler shop.

At Lorain, Ohio, the company's plant covers 43 acres, located on the Black River, about one mile from the harbor entrance. There are four building berths accommodating vessels from 440 feet to 700 feet in length, and two dry docks 549 feet and 700 feet long, respectively. This plant has two fully equipped punch shops, a machine shop, 240 feet by 117 feet; a boiler shop 200 feet by 110 feet; a forge shop fully equipped for heavy forge work, and there is also an electric welder at the plant.

The Buffalo Dry Dock Company, Buffalo, N. Y., which is controlled by the American Shipbuilding Company, is at Ganson street and Buffalo River, and occupies 15 acres, about one and one-half miles from the entrance to the harbor. This yard has one building berth 402 feet long, three dry docks 625 feet by 65 feet, 432 feet by 52 feet, and 382 feet by 45 feet, and the necessary punch and machine shops.

Detroit and Wyandotte Plants

The Detroit Shipbuilding Company, also controlled by the American Shipbuilding Company, has two plants, one at Detroit and the other at Wyandotte, Mich. The Detroit plant occupies 12 acres at the foot of Orleans street, on the Detroit River, and is equipped with a dry dock 368 feet long and 92 feet wide, with 16 feet depth of water over the sill; a machine shop, brass shop and boiler shop.

There is also a foundry building 75 feet by 152 feet equipped with two cupolas, 7½ tons capacity per hour, and a complete brass foundry. The Wyandotte plant, also located on the Detroit River, covers 12½ acres and has two building berths 600 feet long, and punch and machine shops fully equipped.

At Milwaukee, Wis., there are two shipyards owned by the Milwaukee Dry Dock Company and controlled by the American Shipbuilding Company. The South yard, covering 8 acres at the foot of Mineral street, on the Kinnickinnick River, about one-quarter of a mile from the harbor entrance, is equipped with a punch and machine shop for repair work; a dry dock 450 feet long over all, 61 feet wide at the gate with a depth of water of 15 feet 6 inches over the sill, and a floating dock. The West yard, covering 4¼ acres, located on Canal street and the Menominee River, about one mile from the entrance to the harbor, has one dry dock 312 feet long over all, 45 feet wide at the gate, with 15 feet of water over the sill, and a machine shop fully equipped for wood repairs.

Extensive changes have been made at the American Shipbuilding Company's yard at Superior, Wis., which is known as the Superior Shipbuilding Company, whereby its several isolated units can be brought into close relation, permitting more efficient and economical operation of its dry dock and repair work without destroying its

ability to do construction work. The plant occupies 38 acres on Grand avenue and Second street and St. Louis Bay, about one-half mile from the entrance of the harbor. There are two building berths, accommodating vessels up to 600 feet in length, with a fully equipped punch shop and machine shop, and two dry docks. No. 1 dock is 591 feet long over all, with 14 feet of water over the sill, while No. 2 dock is 620 feet long, with 19 feet of water over the sill. A special feature of this plant is the self-propelled steamer *Robert J. Close,* equipped with electric and oxy-acetylene welding apparatus and other outfit capable of making repairs of every nature while vessels are discharging or receiving cargo in the harbor.

The remaining plant controlled by the American Shipbuilding Company is the Western Dry Dock & Shipbuilding Company, Ltd., Port Arthur, Ont., Canada. It comprises 100 acres, located on Current River Park and Thunder Bay, about one mile from Port Arthur and about four and one-half miles from the river mouth at Fort William. At this plant are two building berths, each capable of accommodating vessels up to 700 feet long, and one concrete dry dock 700 feet long, 98 feet wide and 16 feet deep. There are also a fully equipped machine shop, boiler shop, punch shop and foundry building, the latter being equipped with two cupolas of 15 tons capacity per hour.

The Johnson & Lanteri Shipbuilding and Repair Yard

Marine work of all kinds, including shipbuilding and repairs, and especially the construction and repairs of dredges, is carried out by the firm of Johnson & Lanteri, Pittsburg, California.

The company's plant is situated on New York slough, about one mile below the conflux of the San Joaquin and Sacramento Rivers, a location which is particularly adaptable for such work, as it is close to the Great Delta country, where dredges are extensively operated. Deep water is available, so that seagoing vessels can discharge lumber and materials on the company's wharf, making a minimum cost for transportation and, in addition, spur tracks from two trans-continental railroads lead into the yard.

This firm has built many of the largest clam-shell bucket dredgers in the world, some of them swinging 230-foot booms, a size of dredging apparatus which until recently has never been attempted. Although the firm specializes in dredge building and repairing, it also designs and builds boats and barges, and has built some highly successful gasoline (petrol) tow boats for service in and about the bay regions.

A marine ways, suitable for hauling out boats and barges of 100 tons displacement, forms part of the yard's equipment, and the building of a marine railway of 2,500 tons capacity is now contemplated. While wood has been the principal building material used at the yard in the past, the firm is now entering upon the construction of steel vessels, having recently turned out two steel dredger hulls for reclamation work. A set of shear legs, 105 feet high and capable of lifting 80 tons, with a spur track running under them, is located at the end of the company's wharf, which enables the firm to handle boilers and heavy machinery direct from cars to vessels.

Hanlon Dry Dock & Shipbuilding Company, Inc.

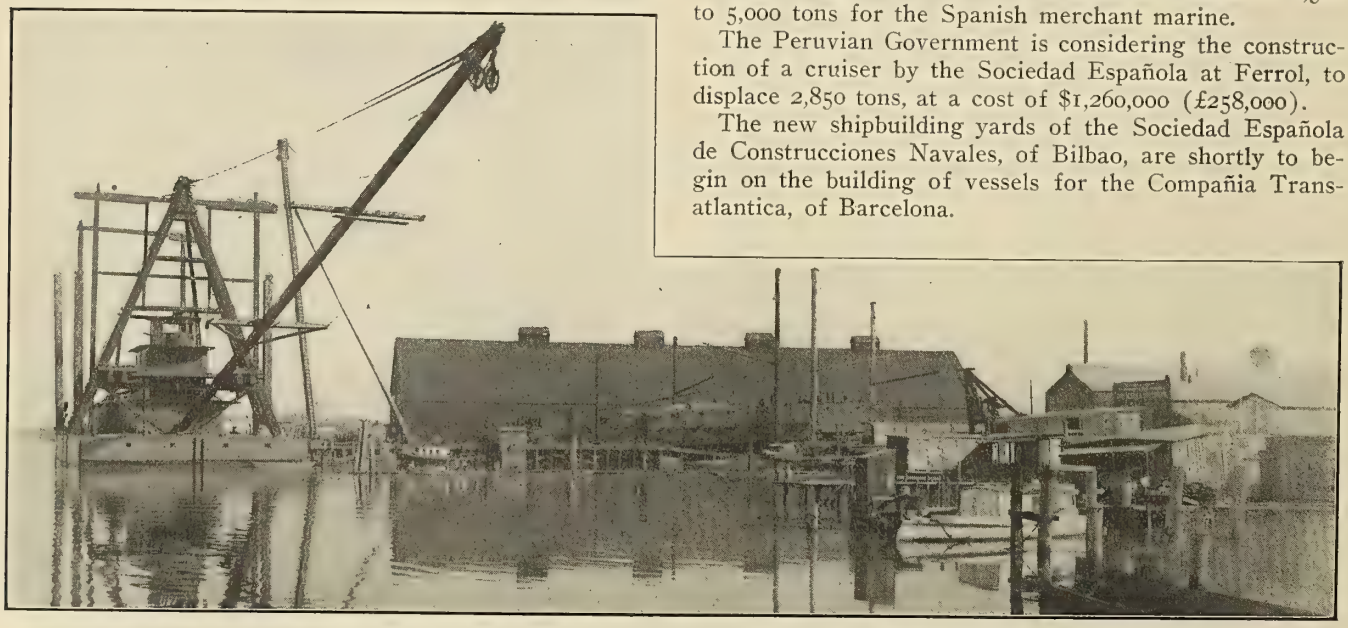
The Hanlon Dry Dock & Shipbuilding Company, Inc., Oakland, Cal., has taken over the business formerly conducted by Mr. D. J. Hanlon, and has built a modern electrically driven marine railway capable of handling a vessel of 4,000 tons, and a smaller marine railway capable of handling a vessel of 1,000 tons at light draft. Among the equipment installed is a machine shop equipped with the most modern motor-driven tools suitable for handling any kind of engine repairs. There is also a complete outfit of wood-working machines and air tools, and from one of the company's wharves now completed, with 35 feet of water alongside, water and electric light can be furnished. With the best submarine diving apparatus obtainable, the company is now in a position to handle any kind of repair work in marine practice.

Shipbuilding Activity in Spain

The shipbuilding yards of Nervion, Spain, are being enlarged to permit of the construction of vessels of 1,500 to 5,000 tons for the Spanish merchant marine.

The Peruvian Government is considering the construction of a cruiser by the Sociedad Española at Ferrol, to displace 2,850 tons, at a cost of $1,260,000 (£258,000).

The new shipbuilding yards of the Sociedad Española de Construcciones Navales, of Bilbao, are shortly to begin on the building of vessels for the Compañia Transatlantica, of Barcelona.



Waterfront of Johnson & Lanteri Plant, Showing Large Clam Shell Bucket Dredger Built by the Company

Fig. 1.—Seattle's Largest Shipyard is Located at the Busiest Part of the City's Commercial Waterfront

Seattle Construction & Dry Dock Company

Modern, Fully Equipped Shipyard in Seattle Now Building Five Large Freighters for the Atlantic Coast

The plant of the Seattle Construction & Dry Dock Company, covering approximately 30 acres, is situated in the busiest part of the commercial waterfront of the City of Seattle. Five transcontinental railroads, the Oregon-Washington Railroad and Navigation Company, the Northern Pacific, Great Northern, Chicago, Milwaukee & Puget Sound, and the Canadian Pacific serve the yard directly. The broad and open fairway of Puget Sound, deep and absolutely unobstructed by bar, reef or shallow, may be followed right up to the company's docks.

The plant is modern in every respect and is equipped for a great range and variety of construction and repair work. The equipment consists mainly of two floating dry docks of 12,000 and 3,000 tons lifting capacity, nine building berths for vessels from 150 to 600 feet in length, a saw mill, planer mill, and sheer legs of 60 and 75 tons capacity. There are four piers ranging from 300 to 750 feet in length for the accommodation of vessels undergoing repairs and receiving equipment.

The shops include a machine shop, pattern shop, foun-

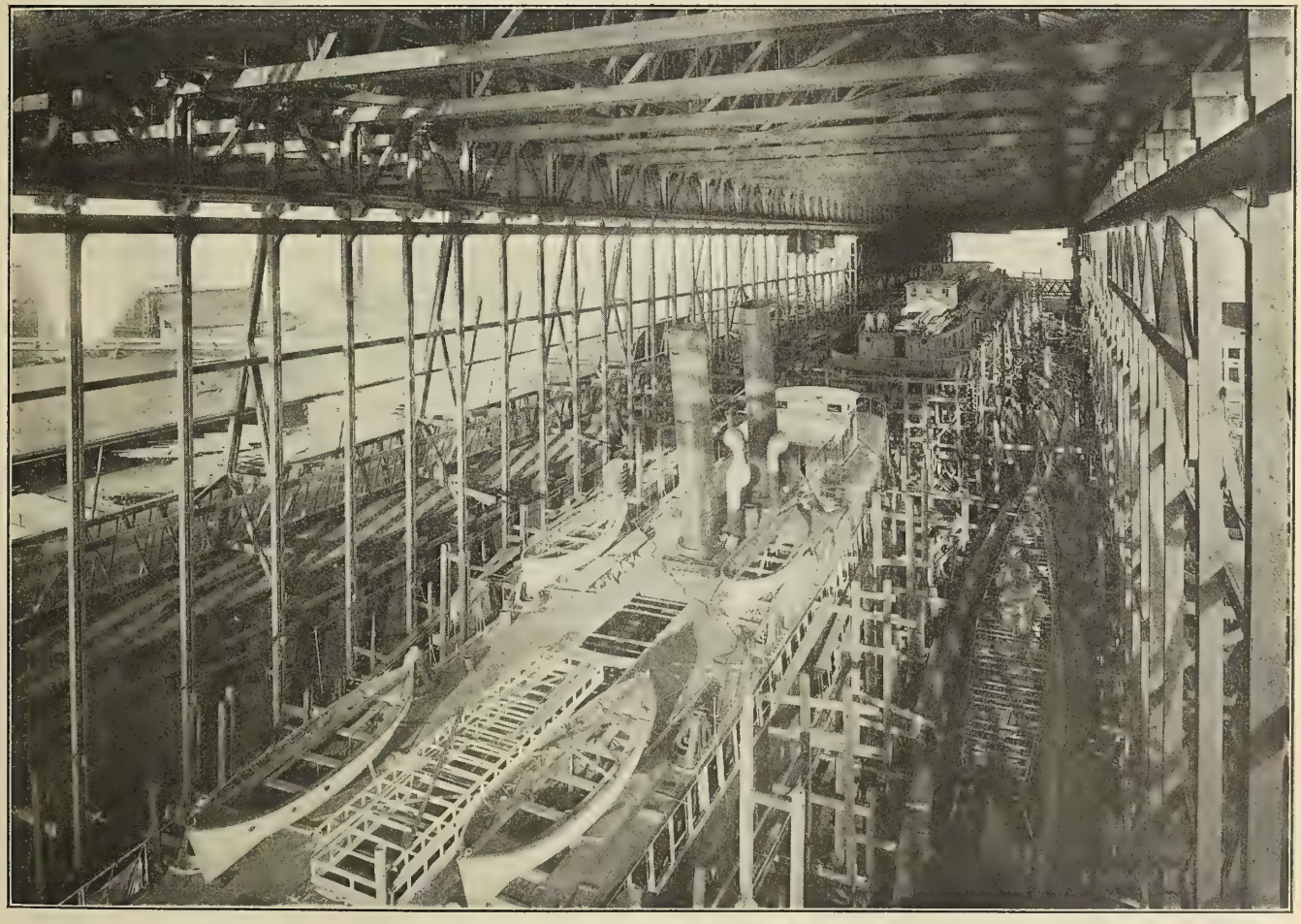


Fig. 2.—Interior of Steel Sheds with Vessels Under Construction

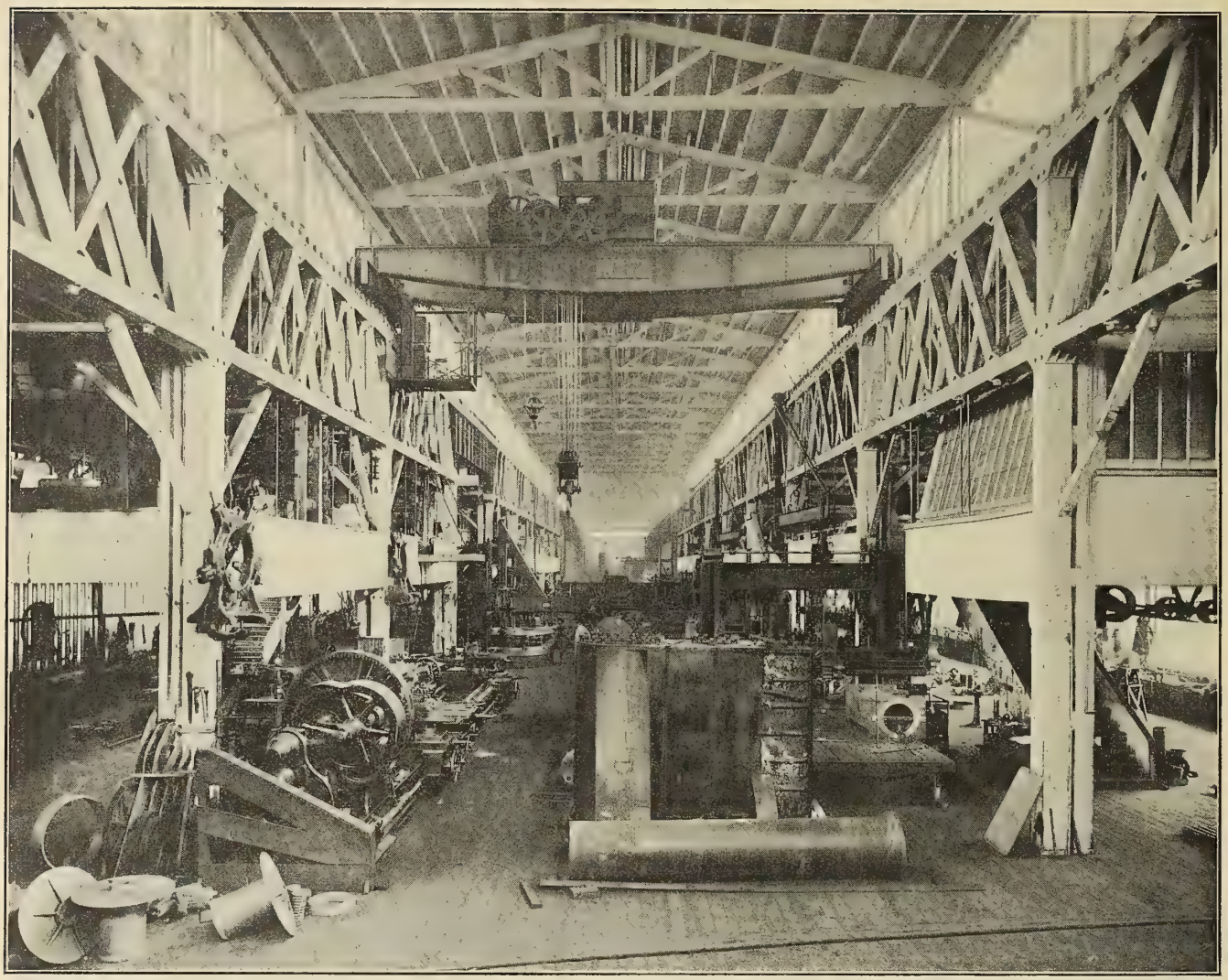


Fig. 3.—Partial View of Machine Shop at Seattle Construction & Dry Dock Plant

dry, joiner shop, carpenter shop, boiler shop, blacksmith and forge shop, bolt shop, pipe shop, galvanizing shop, steel construction shop, mold lofts and power plant of capacities to handle the work required in the construction of ships and in making repairs.

The plant is equipped to handle merchant vessels of all types and also government vessels, now having under construction and contract five freight ships for the Atlantic coast, three submarine torpedo boats and one torpedo boat destroyer, approximating $5,500,000 (£1,125,000) in value.

A large amount of repair work is being carried on on coastwise vessels, and foreign vessels making the Port of Seattle from time to time along with the new construction work.

Increased facilities for handling more tonnage are under consideration, but the details are not yet ready for publication. It is expected, however, that after the improvements are completed the company will be able to handle much more work.

Hannevig Motor-Driven Oil Tankers

Four large motor-driven oil tankers, designed by Cox & Stevens, naval architects, New York, for Cristoffer Hannevig, Christiania, Norway, are now under construction by the Baltimore Dry Docks & Shipbuilding Company, Baltimore, Md. As soon as these vessels are launched three additional vessels of the same size and type, but to be equipped with single-screw geared turbine-propelling machinery, will be laid down, making in all seven large bulk oil carriers for the Norwegian trade.

These vessels are seagoing tank ships, 306 feet long over all, 47 feet beam, 28 feet depth of hold, with a load draft of 22 feet. The oil cargo will be carried in thirteen separate tanks formed by the shell of the vessel and divisional bulkheads, the total tank capacity being 4,500 gallons. Wing tanks provide space for extra cargo when weather conditions will permit deeper loading of the vessels. There are also trimming tanks forward and aft.

The first four vessels will be triple-screw ships, the motive power for each vessel consisting of three four-cylinder Bolinders oil engines of 600 brake-horsepower each. Fuel oil for these motors will be carried in a tank compartment adjacent to the engine room, with a capacity of 500 tons of heavy oil. Geared turbine propelling machinery supplied with steam by oil-fired Scotch boilers, will be substituted for the oil engines in the last three vessels, in order to secure a comparison of the results when using each type of power.

The question of auxiliaries has been carefully worked out, also the piping arrangements for handling and heating the oil, as well as the equipment for navigating and operating the vessels, so that the expense of operation will be reduced to a minimum without in any way sacrificing the efficiency of loading and transporting the cargo.

Record Year for the Union Iron Works Co.

San Francisco Shipyard, a Subsidiary of the Bethlehem Steel Corporation, Building Nineteen Vessels Aggregating 179,078 Tons

With nineteen large steamships, aggregating 179,078 tons, under construction, the Union Iron Works Company, San Francisco, Cal., is entering upon the most active year in its history. This company entered the steel shipbuilding field in 1882 and since that time has built 120 vessels of various types, including both naval and merchant ships, and the company's plant has been developed into the largest establishment for the building and repairing of ships on the Pacific coast.

The main works are at the Potrero on San Francisco Bay, about two miles from the city, covering 38 acres, while at Hunter's Point, about 1½ miles from the Potrero works, the company owns property covering 45½ acres where there are two graving docks, 750 feet and 483 feet long respectively, and where a new graving dock 1,096 feet long by 120 feet wide, with a depth of water of 40 feet over the sill, capable of docking the largest vessel that can pass through the locks of the Panama Canal, is to be built.

The main works at the Potrero are divided into two parts, the North Works and the South Works. The North Works contains seven building slips, two floating dry docks, numerous mooring berths, a set of 120-ton shear legs and the extensive shops which go to make up the complete plant with the exception of the pattern shop, brass and iron foundries, machine shop, erecting shop and bolt and rivet shop, which are located at the South Works.

The Union Iron Works Company became a subsidiary of the Bethlehem Steel Corporation in 1905, and since that time extensive improvements have been made, including the complete electrification of the plant, the construction of a new punch shop, blacksmith shop, saw mill and joiner shop, rigging loft, pipe fitters' shop, coppersmith shop, sheet iron shop, marine machinists' shop, marine electrical shop, four new building slips, a new brass foundry and the rearrangement of the storage yard and crane and conveying facilities. The new shops are of modern steel, concrete and brick construction elaborately equipped with complete systems of overhead traveling cranes and the necessary facilities for handling unfinished and fabricated materials.

In replacing four of the old wooden building slips, which were of wood wharf construction with wood overhead framing for the traveling cranes, the new slips were planned so that the weight of the ships will be carried on the original piles with new caps and stringers where required, and made flush with the surface with rock filling between and below in place of the old wood wharf surface. The wood overhead framing for the traveling cranes has been discarded for steel viaducts about 60 feet high running the full length of the slips. Each viaduct is designed to carry a 30-ton electric locomotive crane traveling on a 10-foot gage track with booms reaching 10 feet beyond the centerline of the vessels on the ways.

Although the plant has a water frontage over a mile long, it has recently been reported that the company has bought the plant of the United Engineering Works in San Francisco, in order to furnish additional facilities for building steel hulls and engines.

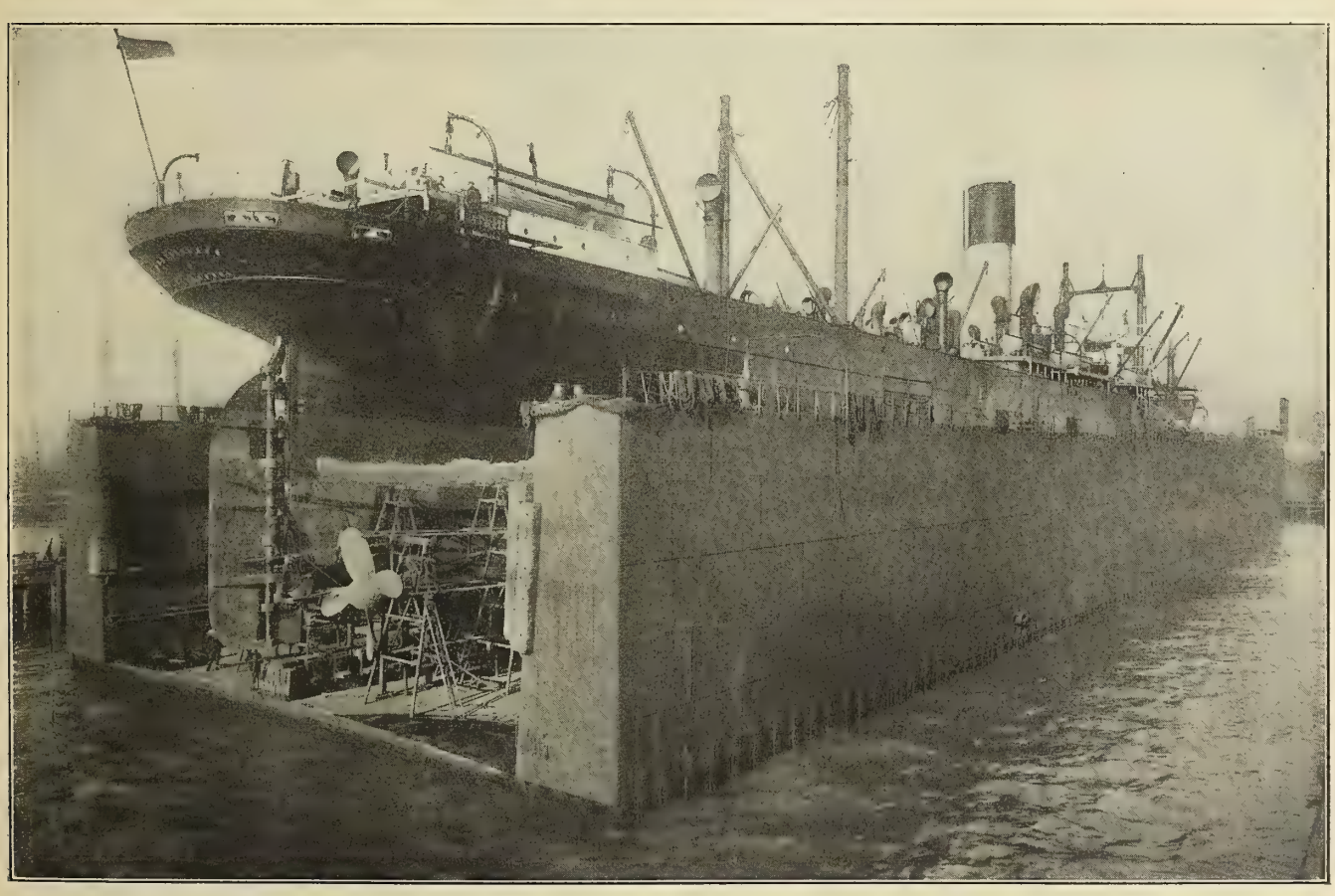


Fig. 4.—Steamship *Protesilaus* of 9,547 Tons in Floating Dry Dock of Seattle Construction & Dry Dock Company

Fig. 1.—Plant of the California Shipbuilding Company

California Shipbuilding Company

Plant for Building Lake Submarines on the Pacific Coast —Docking and Building Facilities for Merchant Vessels

The California Shipbuilding Company, the only steel shipbuilding, repairing and docking plant in Southern California, is at Long Beach, on San Pedro Bay, adjacent to San Pedro, the port of Los Angeles. It is about one hundred miles north of the Mexican border and four hundred miles south of San Francisco. In addition, there are thousands of miles of the coast line of West Mexico and Central America lacking entirely the service and equipment afforded by this company.

The yard was established in 1906 by the Craig Shipbuilding Company, and was sold on January 1, 1916, to the California Shipbuilding Company, which has the exclusive rights on the Pacific Coast to build submarine boats under the patents of the Lake Torpedo Boat Company, of Bridgeport, Conn. The intention of the company is to specialize, so far as construction work is concerned, in submarine boats. At the same time it is prepared to construct other types of Government and merchant vessels.

The layout of the yard in relation to the harbor readily adapts itself to the side-launching method, and the long front is, therefore, fitted with building berths on that principle. Two large overhead cranes travel the entire length over the berths and form in conjunction with a large number of spur railroad tracks, minor swinging and traveling cranes, and a narrow-gage push-car system, an economical and rapid scheme for handling material. A large new office building and various smaller buildings, such as storehouses, will be erected, besides other improvements; a new fitting-out wharf, with heavy sheer-legs, yard locomotive crane, electric charging plant for storage batteries, and extensive additions and improvements to the tools. The arrangement of the yard is such that, if necessary, several vessels could be built and launched endwise, in addition to the large frontage on which the side launching method is used.

Fig. 2.—3,500-Ton Dry Dock at the California Shipbuilding Plant

Considering the amount of repair and docking work done by the company, the large floating dry dock is one of the most important features. Designed by Wm. T. Donnelly, consulting engineer, New York, it represents the latest practice, and can handle 3,500 tons deadweight. The design is such that when the business afforded warrants it the dock can be greatly enlarged by merely adding additional units to the length. It is self-docking, as any portion can be detached readily, should repairs be necessary, and lifted by the intact portion. The dock is quickly operated by electrically driven pumps.

Electricity furnishes practically all the power required throughout the plant, and oil fuel is used entirely. The Union Oil Company's pipe line runs into the yard, and the Standard Oil Company also has a service station adjacent.

One of the best assets of the California Shipbuilding Company is the splendid climate of Long Beach, where ship construction and repairing can be carried on without the vexatious layoffs for frequent rains, snow and cold weather that so often embarrass most American ship yards. There is no snow at all, and rains only in the short winter season.

The work under way at present consists of the following: Submarines *L*-6, *L*-7, *O*-14, *O*-15 and *O*-16, and the lighthouse tender *Cedar*. The value of contracts for new construction is over $3,000,000 (£615,000). The plant is well equipped at present to handle, in addition to the foregong, two merchant vessels not exceeding 400 feet in length.

The company aims to enlarge the shipyard and increase the number of men. In war to-day a nation's fate hangs largely upon its practical force of engineers and skilled workmen. The company's purpose is sincere cooperation in the nation's preparedness policy, and the Government may have first call upon the company's men and shipyard.

Fig. 1.—Partial View of Waterfront at Hall Brothers Shipyard

Hall Bros. Shipbuilding and Repair Plant

Puget Sound Yard Noted for the Beauty and Seaworthiness of the Wooden Sailing Vessels Built

With the growth and development of the wood shipbuilding industry on the Pacific coast, the firm of Hall Brothers, and their successors, the Hall Brothers Marine Railway & Shipbuilding Company, Eagle Harbor, Winslow, Wash., has been closely identified. The firm was organized in San Francisco, Cal., in 1872, by the Hall brothers, who were experienced builders of the famous Gloucester type of fishing vessels on the Atlantic coast, and the shipyard was established at Port Ludlow, Wash. In 1882 the plant was moved to Port Blakeley, and in 1902 to its present site in Eagle Harbor, where there is a water frontage of half a mile and ample facilities for building and repairing wooden craft as well as for manufacturing ship's spars.

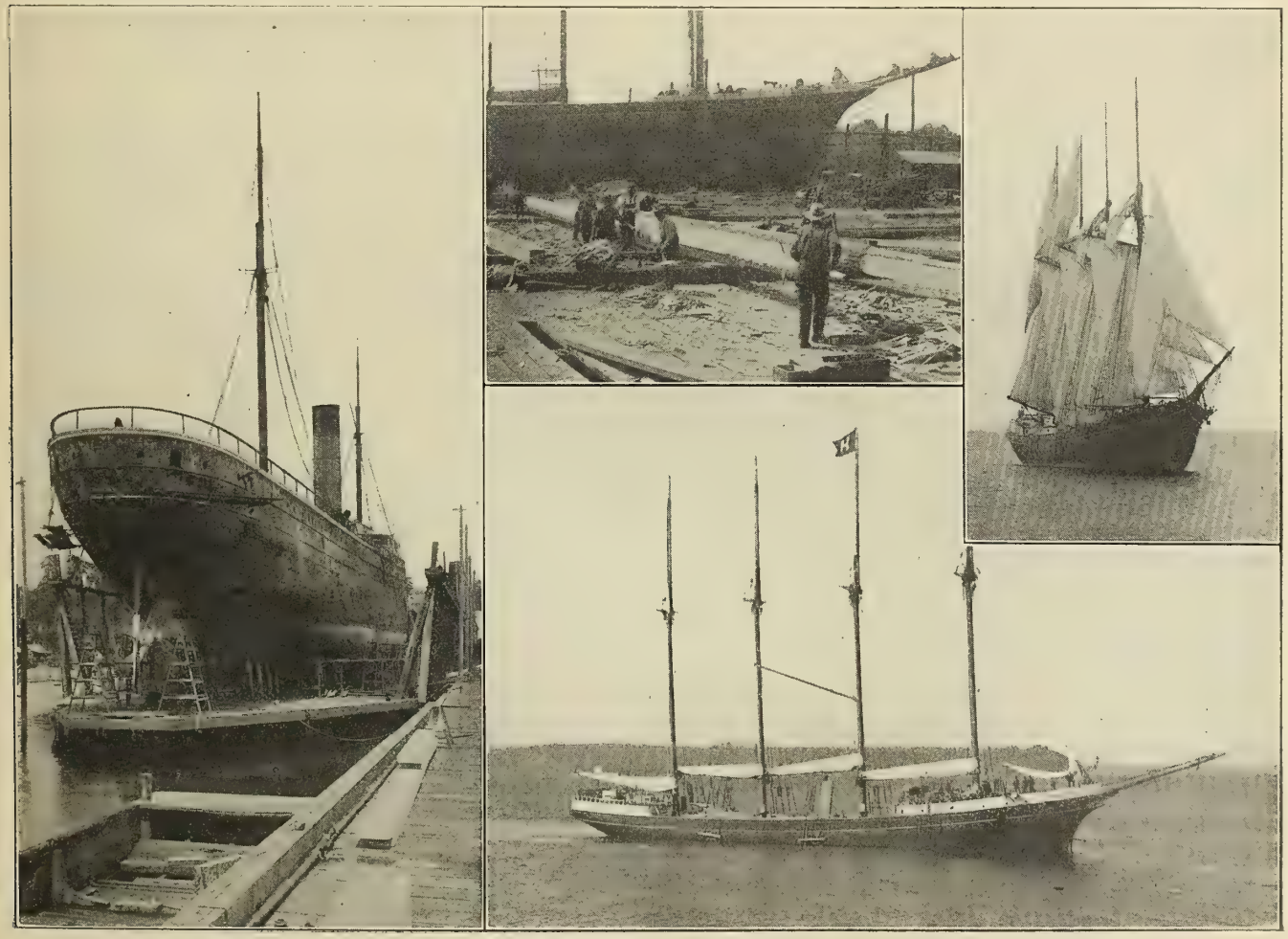


Fig. 2.—Character of the Work Handled by the Hall Brothers Marine Railway & Shipbuilding Company

During its existence the firm has built a total of 140 vessels, mostly wooden sailing vessels for the lumber trade, although in recent years, with the advent of the steam lumber schooner, there has been a gradual change to steel construction for this trade. While the Hall shipyard is not equipped for steel construction, it has nevertheless produced a number of wooden steam schooners, the size of which is limited to 250 feet in length, which the company considers the maximum size practicable for a wooden ship of the single deck type.

The yard is equipped with tools for hull repairs, tail shaft work, engine repairs and any character of iron work in connection with the wooden sailing vessels or small steamers plying Puget Sound or in the coasting trade. The yard has building slips capable of accommodating six vessels at one time. Three of the slips are covered and permit work being carried on during any kind of weather. In addition there are two railway dry docks, one of which, of the Crandall type, with a steel cradle 325 feet long, is capable of hauling vessels up to 4,000 tons deadweight. The other dock, with a cradle 136 feet long and a capacity of 400 tons deadweight, is arranged with a long haul inshore, provided with skids for side-tracking vessels for winter storage. Both the building slips and the marine railways are piped for air and a complete complement of air tools for use in repair or construction work is available. Compressed air is supplied by two Ingersoll-Rand compressors with a capacity of 750 cubic feet of air per minute.

The shops in the yard consist of a forge shop, boiler shop, machine shop and a combined sawmill and joiner shop, together with a mold loft.

An important part of the company's business is the installation of ship's spars, as the Oregon pine, or Douglas fir timber, as grown in the Puget Sound district, provides the best spars obtainable in any part of the world for ships.

The company is famous not only for the number of wooden sailing vessels which it has built, but also for the exceptional beauty and seaworthiness of the vessels which they have designed, which have included some of the largest and most successfnl sailing vessels built on the Pacific coast.

Inclined Elevators Increase Economy of Handling Freight at New York Central Weehawken Piers

At the Weehawken, N. J., piers of the New York Central Railroad Company, where inclined elevators, manufactured by the Otis Elevator Company, New York, have been installed for moving freight up the inclined gangways connecting the piers to vessels alongside, savings amounting to 3 cents per ton have been made over what it would have cost to handle the freight at these piers by hand. During the year 1915, 105,508 tons of freight were handled by the inclined elevators, and it is roughly estimated, after deducting interest, maintenance, depreciation and the cost of power, that the above saving resulted.

As to the effect which the elevators have had upon the length of time in handling the freight and in preventing congestion in the movement of the freight, conditions in New York harbor have undergone such a transformation within the past year that no comparisons can be made. There is no doubt, however, that these machines make it possible to unload lighters at the piers more quickly than it could be done without the elevators. This saving of time varies from 20 to 40 percent, and depends upon the tide, the character of the freight and the conditions on the floor to which the freight is being transferred, whether open or congested.

Willamette Iron and Steel Works

Since 1900 the Willamette Iron & Steel Works, Portland, Ore., which was formerly engaged in machinery and foundry work, has become an important shipbuilding and repair yard. Its plant, which covers five acres on the water front of the city and employs four hundred men, is divided into several departments, including, in addition to the shipyard, a logging and hoisting engine department and a plate department. Adjoining the shipyard is the plant of the Oregon Dry Dock Company, which enables efficient and economical ship repair work of all kinds to be carried out.

The boiler shop of the Willamette Iron & Steel Works is equipped with modern machinery for handling all classes of plate work up to 1⅛ inches thickness, and this equipment has enabled the company to carry out some of the most important plate work on the Pacific coast, including pen stocks and other work besides boiler work.

As this is the only shipbuilding plant in Portland where steel vessels are built, many of the vessels now employed on the Columbia and Willamette rivers have been built by this company. Their output has also included barges, dredges, tugs and passenger and work boats.

J. F. Duthie and Company

Although a comparatively newcomer among the Pacific coast shipbuilders, the firm of J. F. Duthie & Co., which has been in operation in Seattle, Wash., for about three years, has built four steel and one wooden vessel. The company's plant is equipped to handle vessels up to 200 feet in length, and, besides ship work, specializes in the construction of winches, windlasses and hoists. The vessels built by the firm include two steam whalers, a fishing steamer, a steam ferryboat and a cannery tender.

CORRECTION.—In the formula $V^3/\text{I. H. P.} = 436.16$, printed near the top of the second column on page 60 of our February issue, the factor "immersed midship section" was omitted. The formula should read:

$$\frac{\text{Immersed Midship Section} \times V^3}{\text{I. H. P.}} = 436.16.$$

On page 82 of the same issue, near the top of the second column, the equation $210 \times 32 = 178$ B. T. U., should read $210 - 32 = 178$ B. T. U., and the equation

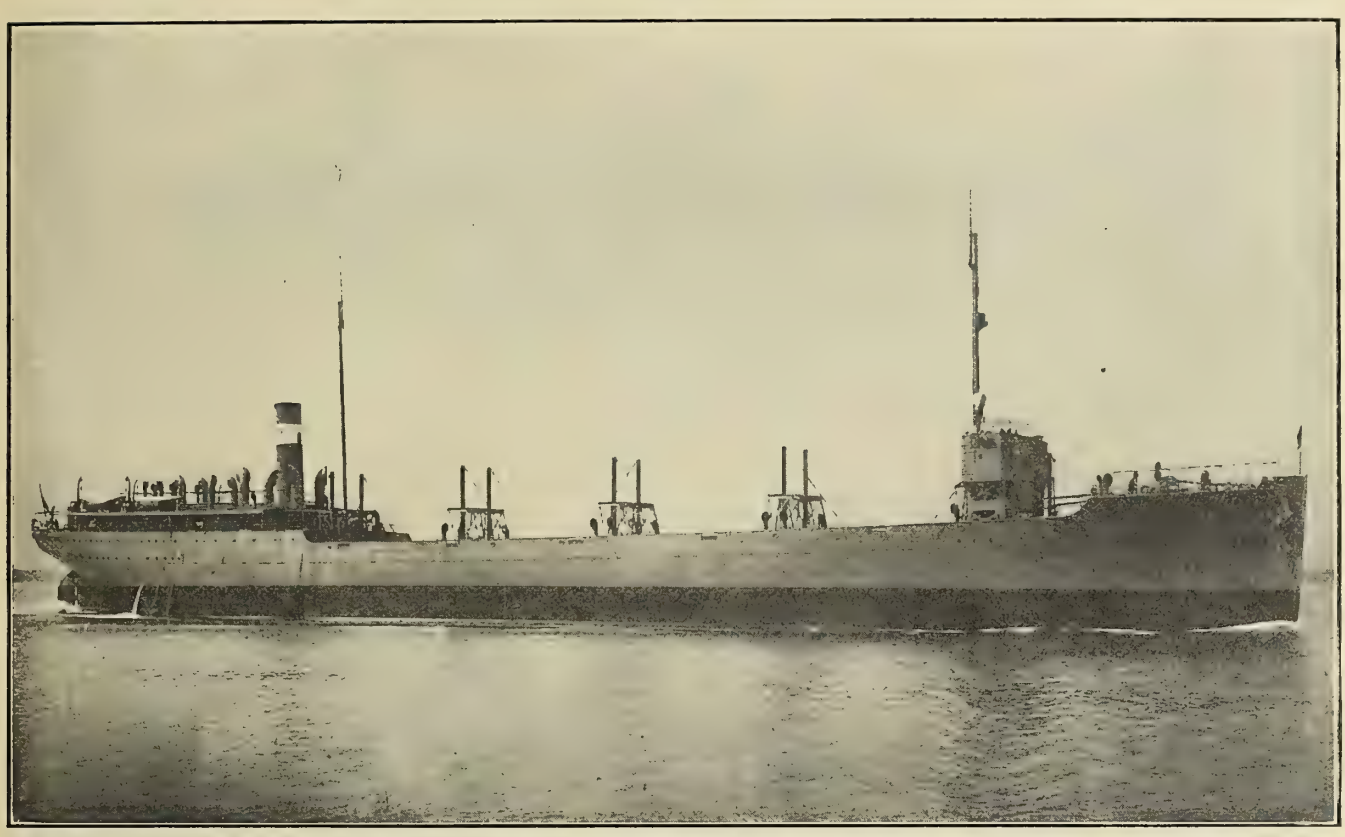
$$\frac{990{,}000 \times 60}{778} = 2{,}545 \text{ B. T. U. per hour}$$

should read

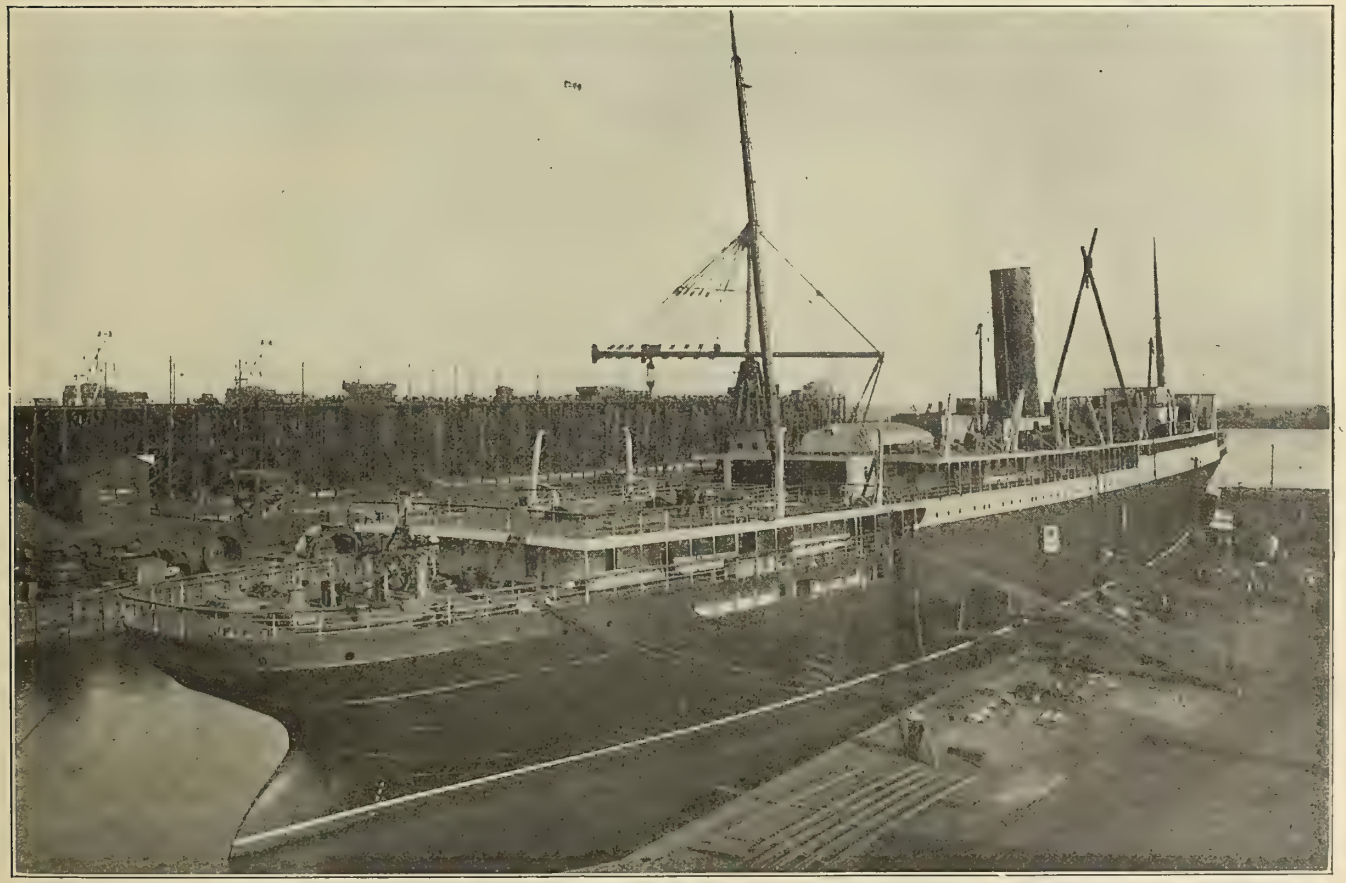
$$\frac{33{,}000 \times 60}{778} = 2{,}545 \text{ B. T. U. per hour.}$$

LLOYD'S QUARTERLY RETURNS.—The returns compiled by Lloyd's Register of Shipping, which take into account only vessels of 100 tons and upwards the construction of which has actually begun, show that, excluding warships, there were 420 vessels of 1,363,590 gross tons under construction in the United Kingdom at the close of the last quarter. The tonnage now under construction in the United Kingdom is about 173,000 tons less than that which was in hand at the end of the previous quarter, and about 264,000 tons less than that building a year ago.

Types of Ships Built in American Yards



Panama Collier *Achilles*, Built by the Maryland Steel Company, Sparrows Point, Md.



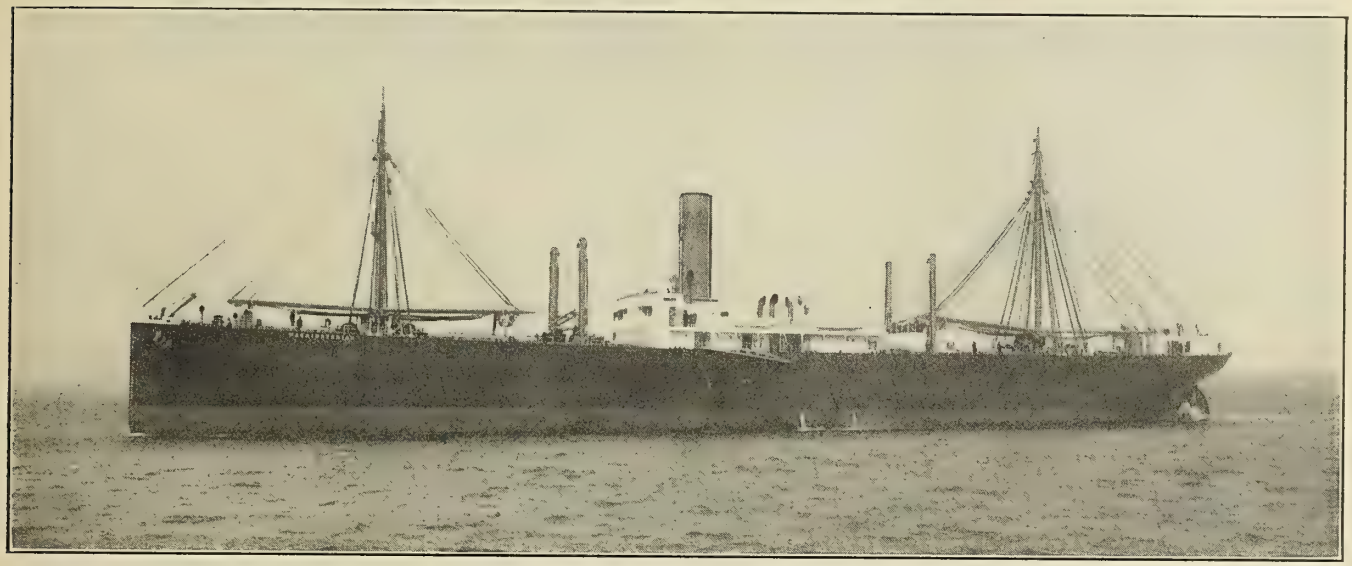
23-Knot Turbine Passenger Steamer *Great Northern*, Built by Wm. Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa.

Coastwise Collier *Jonancy*, Built by the New York Shipbuilding Company, Camden, N. J., for the Pocahontas Navigation Company, Boston, Mass.

Self-Unloading Lake Freighter *W. F. White*, Built by the American Shipbuilding Company, Cleveland, Ohio, for the Limestone Transportation Company

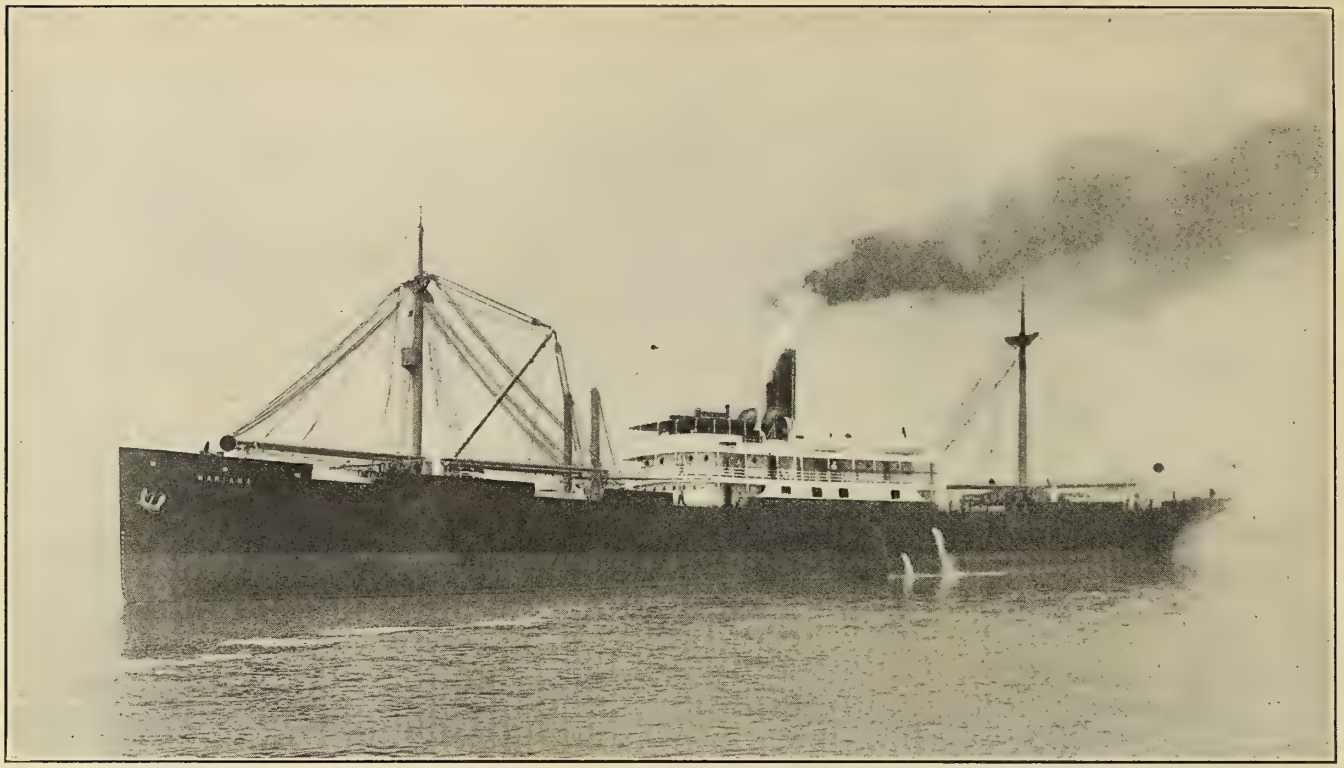
Bulk Freighter *Howard M. Hanna, Jr.*, Built by the American Shipbuilding Company, Cleveland, Ohio, for the Hanna Transit Company, Cleveland, Ohio

S. S. *Franklin*, Built by the New York Shipbuilding Company for the Coastwise Transportation Company, Boston, Mass.



S. S. *Washingtonian*, Built by the Maryland Steel Company, Sparrows Point, Md., for the American-Hawaiian Steamship Company, New York

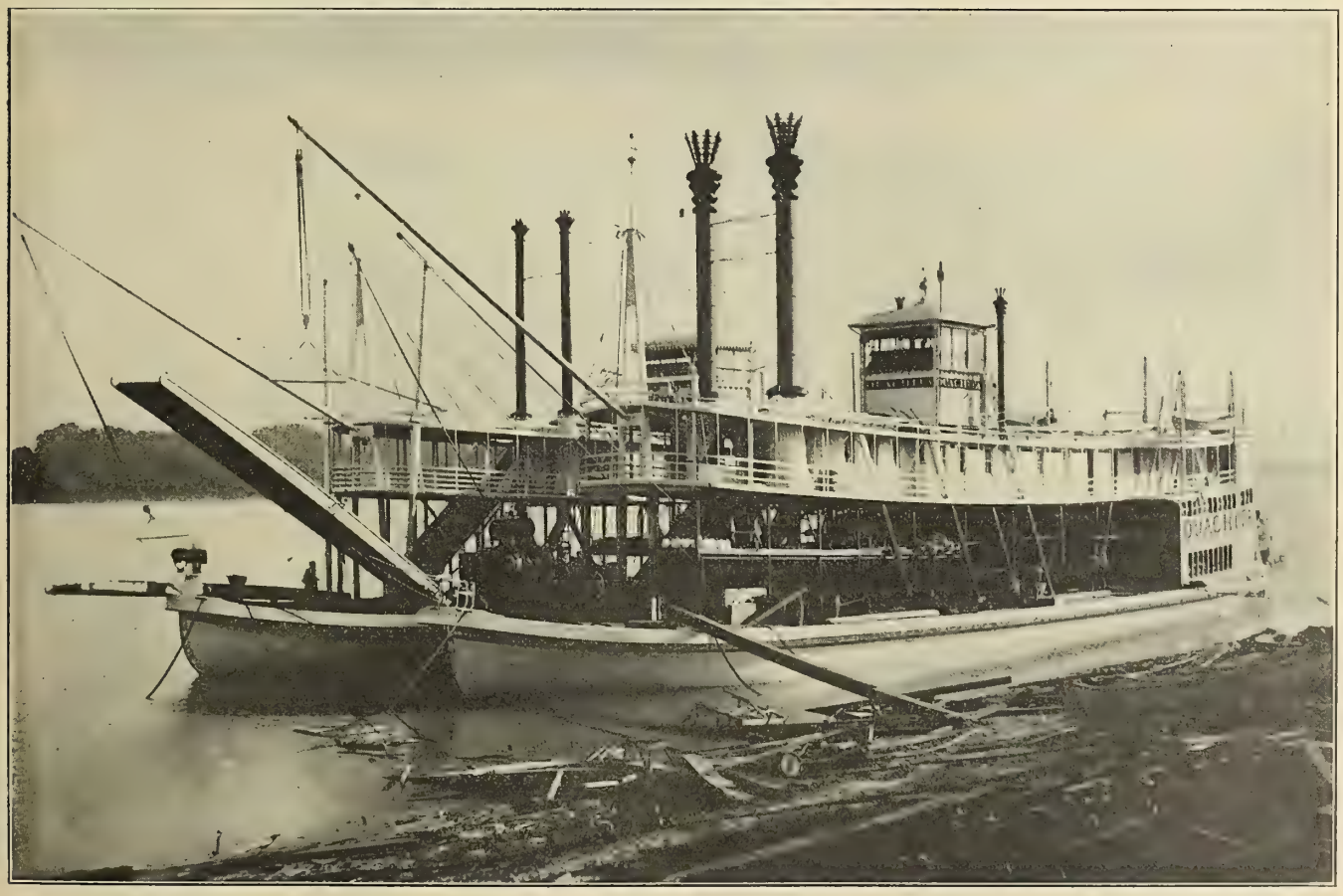
S. S. *Edith*, Built by the Maryland Steel Company, Sparrows Point, Md., for the A. H. Bull Steamship Company, New York



S. S. *Mariana,* Built by the Newport News Shipbuilding & Dry Dock Company, Newport News, Va., for the New York & Porto Rico Steamship Company, New York

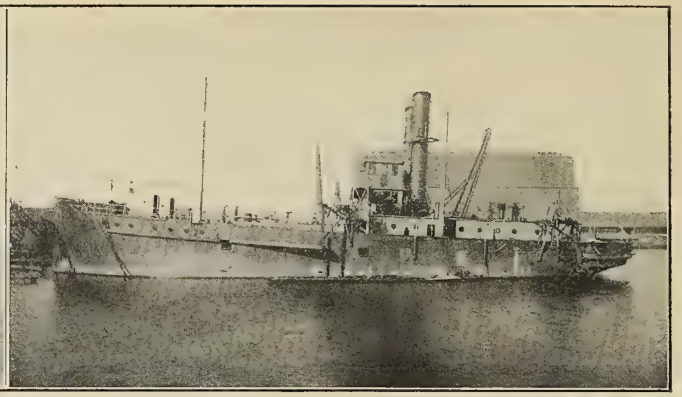
United States Battleship *Texas,* Built by the Newport News Shipbuilding & Dry Dock Company, Newport News, Va.

S. S. *Walter D. Noyes*, Built by the Newport News Shipbuilding & Dry Dock Company, Newport News, Va., for the Crowell & Thurlow Steamship Company, Boston, Mass.

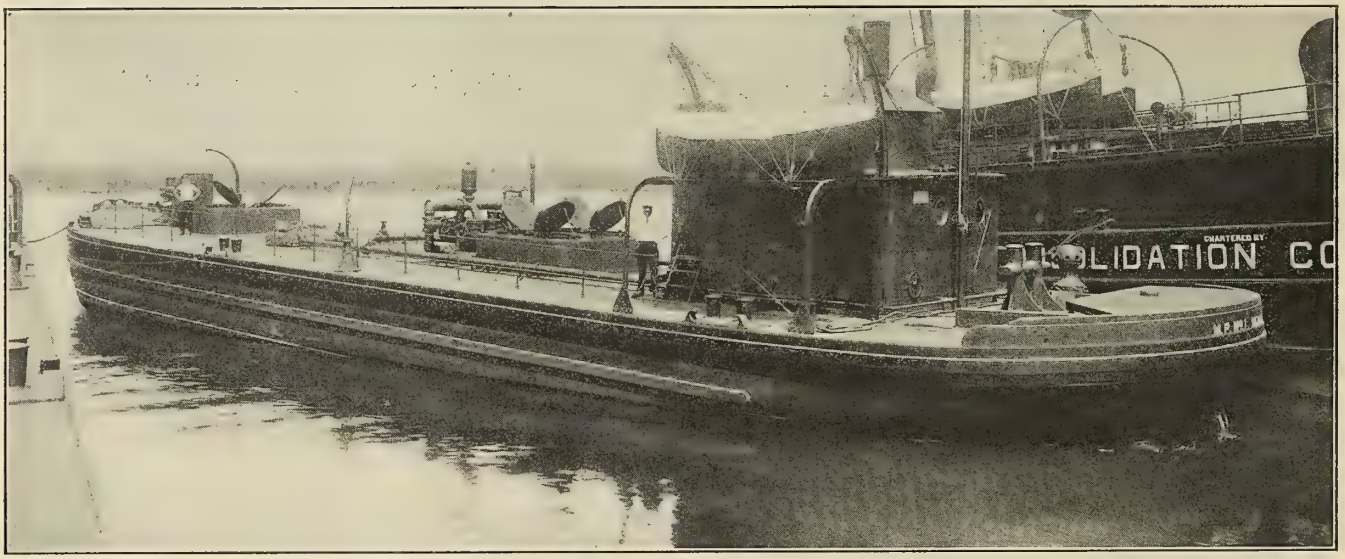


Mississippi River Cotton Boats, Built by the Howard Ship Yards Company, Jeffersonville, Ind.

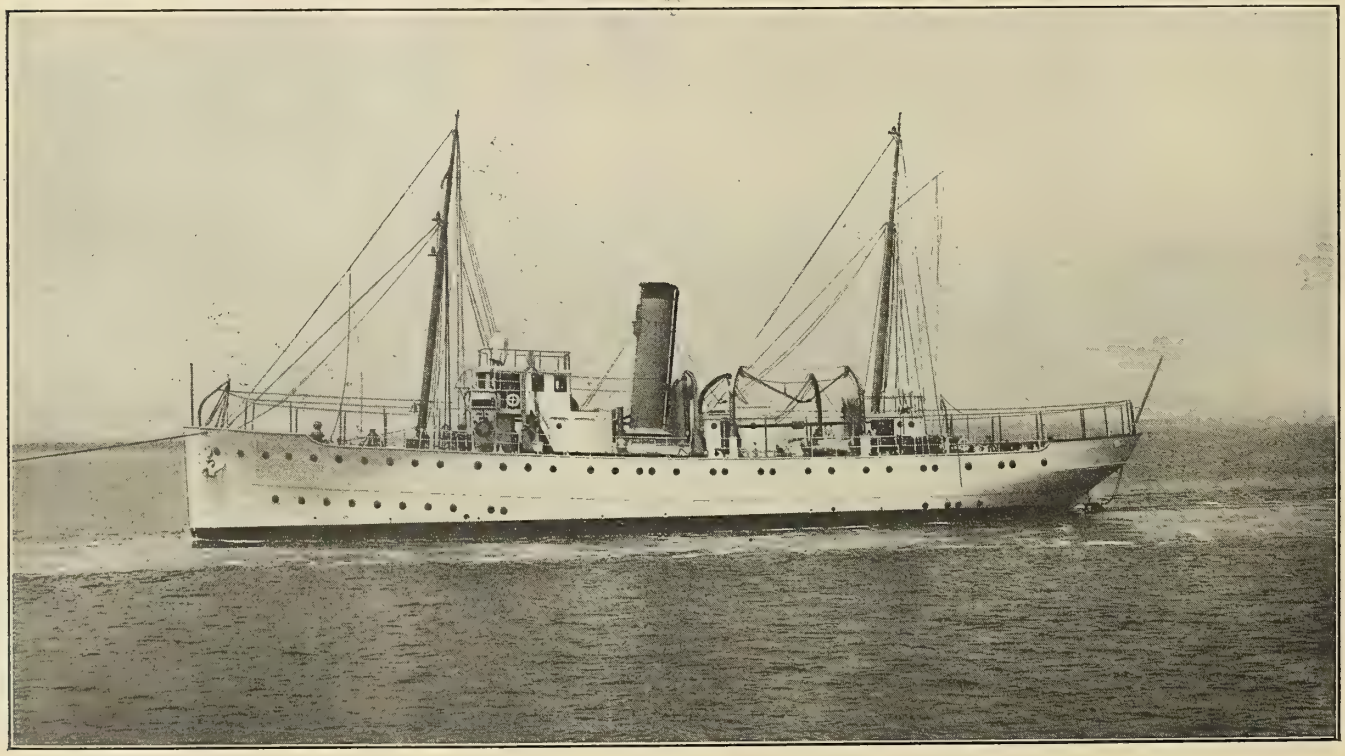
U. S. S. Dredge *Col. P. R. Michie*, Built by the Seattle Construction & Dry Dock Company, Seattle, Wash.



Sea-going Hopper Dredge *San Pablo*, Built by the Baltimore Dry Docks & Shipbuilding Company, Baltimore, Md.



Oil Barge Built by the Baltimore Dry Docks & Shipbuilding Company, Baltimore, Md., for the Huasteca Petroleum Company, New York



U. S. Coast Guard Cutter *Ossipee*, Built by the Newport News Shipbuilding & Dry Dock Company, Newport, News, Va.

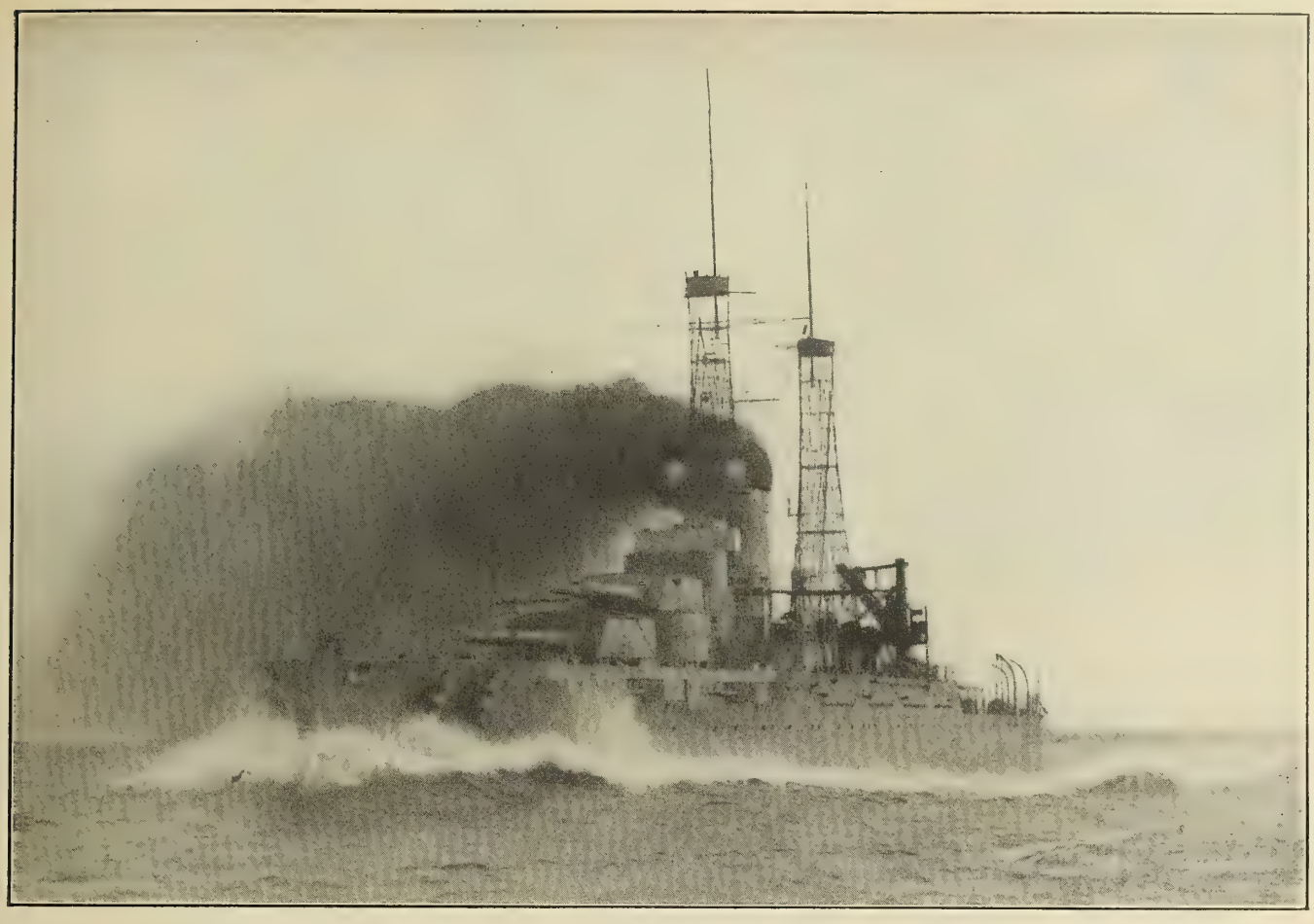


Fig. 1.—The *Nevada*, Making 21.04 Knots on Her Official Trials

United States Battleship Nevada

Built by the Fore River Shipbuilding Corporation and Equipped with Curtis Turbines

The battleship *Nevada*, with her sistership the *Oklahoma*, was authorized by an Act of Congress, approved on March 4, 1911. The contract for the construction of the *Nevada* was placed with the Fore River Shipbuilding Corporation, Quincy, Mass., on January 22, 1912, the price being $5,879,000 (£1,205,000) exclusive of armor and armament and the time of construction 36 months.

The *Nevada* is a twin screw vessel fitted with Curtis turbines, designed for a speed of 20½ knots at 27,500 tons trial displacement with the engines developing 26,500 shaft horsepower. A supplementary contract was made with the builders on June 31, 1914, increasing the contract price $50,000 (£10,250) and the time of construction 5 months, in order to cover the installation of a geared cruising turbine on each shaft, and at the same time changes were made by the builders in the design of the main turbines, reducing the numbers of rows of blades, increasing the blade clearances and changing the method of securing the blades.

The principal dimensions of the *Nevada* are as follows:

Length over all	583 feet
Length between perpendiculars	575 feet
Beam, molded	94 feet 10⅛ inches
Depth, molded at side to main deck	44 feet 5½ inches
Load draft	28 feet 6 inches
Mean trial displacement	27,500 tons
Tons per inch immersion at load waterline	93.2 tons
Area of midship section	2,665 square feet
Area of load waterline plane	39,160 square feet
Area wetted surface	65,700 square feet
Coefficient of fineness	0.6168

The vessel has a single smokestack and two cage masts.

The main armament consists of ten 14-inch guns, arranged in four turrets on the centerline of the ship. The two forward turrets are located on the upper deck and the two after turrets on the main deck. The extreme forward and after turrets have three guns each and the other turrets two guns each. The turrets are electrically operated through variable speed gear.

The secondary battery consists of twenty-one 5-inch guns, located, seven on the second deck, twelve on the main deck and two on the superstructure deck. There are also four air defense guns; four 3-pounder guns for saluting; two 1-pounder guns for boats; two 3-inch field pieces, and two 30-calibre machine guns.

The captain's quarters are on the upper deck abaft the second turret, while the officers' quarters are forward on the main and second decks. Amidships on the second deck are the principal executive offices. The galleys for the officers and crew are on the main deck. In the space around the uptake on the third deck are a foundry and coppersmith and blacksmith shops.

Propulsion is by Curtis turbines, arranged on two

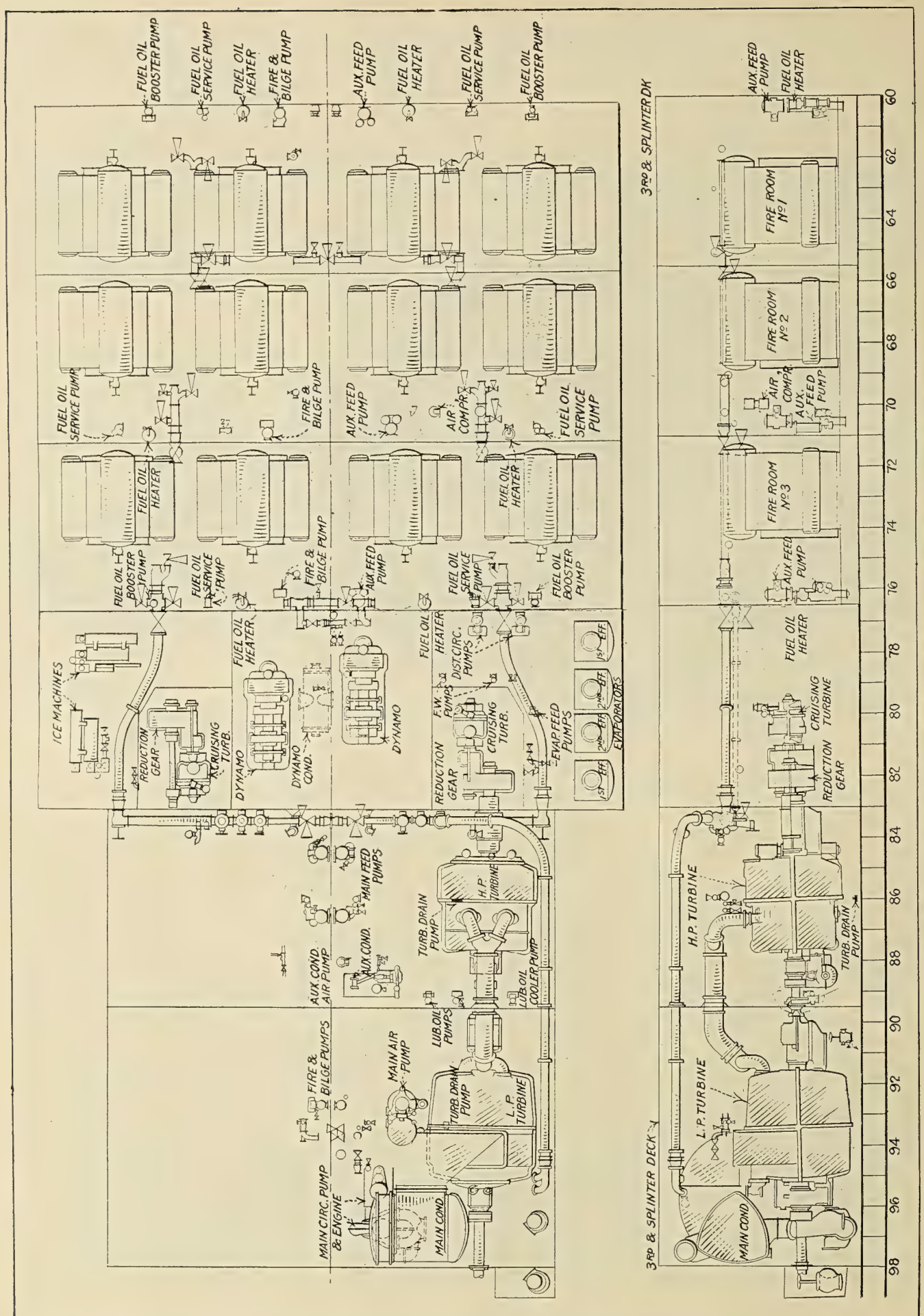


Fig. 2.—Diagram Showing Plan and Elevation of Boiler and Engine Rooms of the *Nevada*

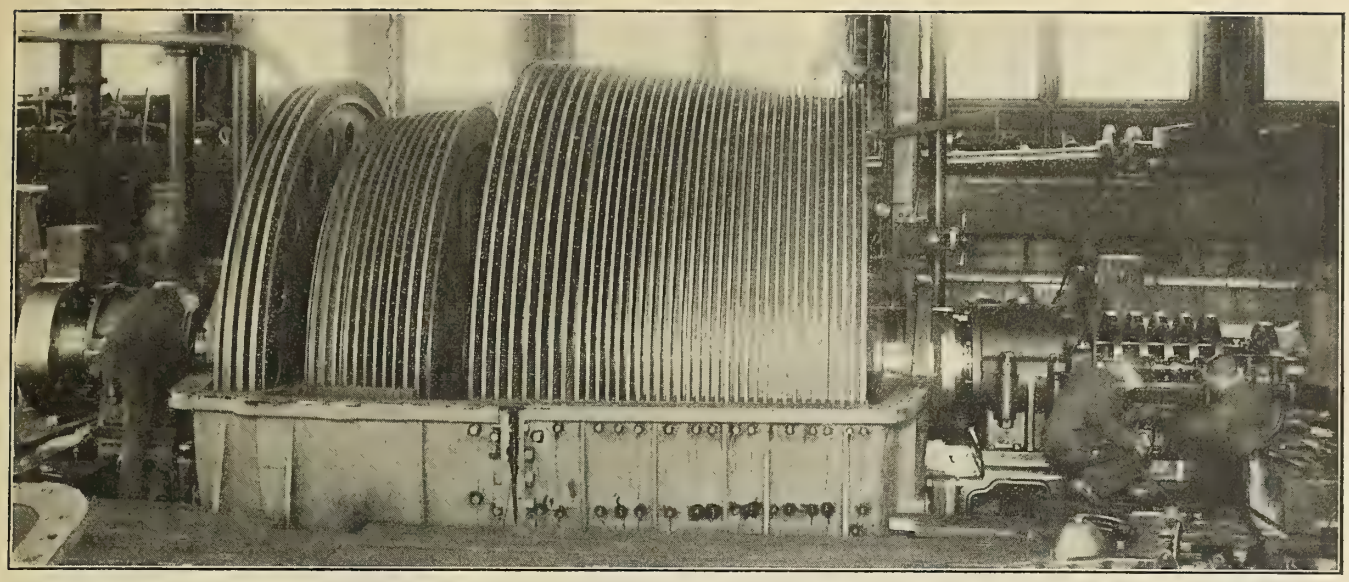


Fig. 3.—Low-Pressure Turbine with Astern Turbine

shafts in four watertight compartments, supplied with steam at 295 pounds per square inch pressure from twelve Yarrow watertube boilers arranged in three watertight compartments.

As shown on the plan, Fig. 2, in each forward engine room there is a geared cruising turbine connected to the main shaft by means of a jaw clutch, and one 132-inch diameter high-pressure turbine. In each after engine room there is one 138-inch diameter low-pressure turbine and a reversing turbine in a single casing. The main turbines are designed to develop, collectively, 26,500 shaft horsepower at about 222 revolutions per minute. The cruising turbines are designed to develop 1,750 shaft horsepower each at 3,200 revolutions per minute and are geared down in the ratio of 23.85 to 1. The cruising units may be used at all speeds ahead below 15½ knots but are disconnected for higher speeds and when reversing.

Each high-pressure turbine consists of five wheel stages, a forward and an after drum. The first stage consists of four moving rows and the other wheel stages have two moving rows each. The five stage wheel is secured to the forward end of the forward drum, which has nine single row stages, while the after drum has sixteen single row stages. The two drums are so designed as to practically balance the steam thrust in the high-pressure turbine at all speeds.

The low-pressure turbines consist of a drum with thirty-eight single row stages. The reversing turbines, incorporated in the same casings as the low-pressure turbines, consist of one stage with four moving rows of blades, one

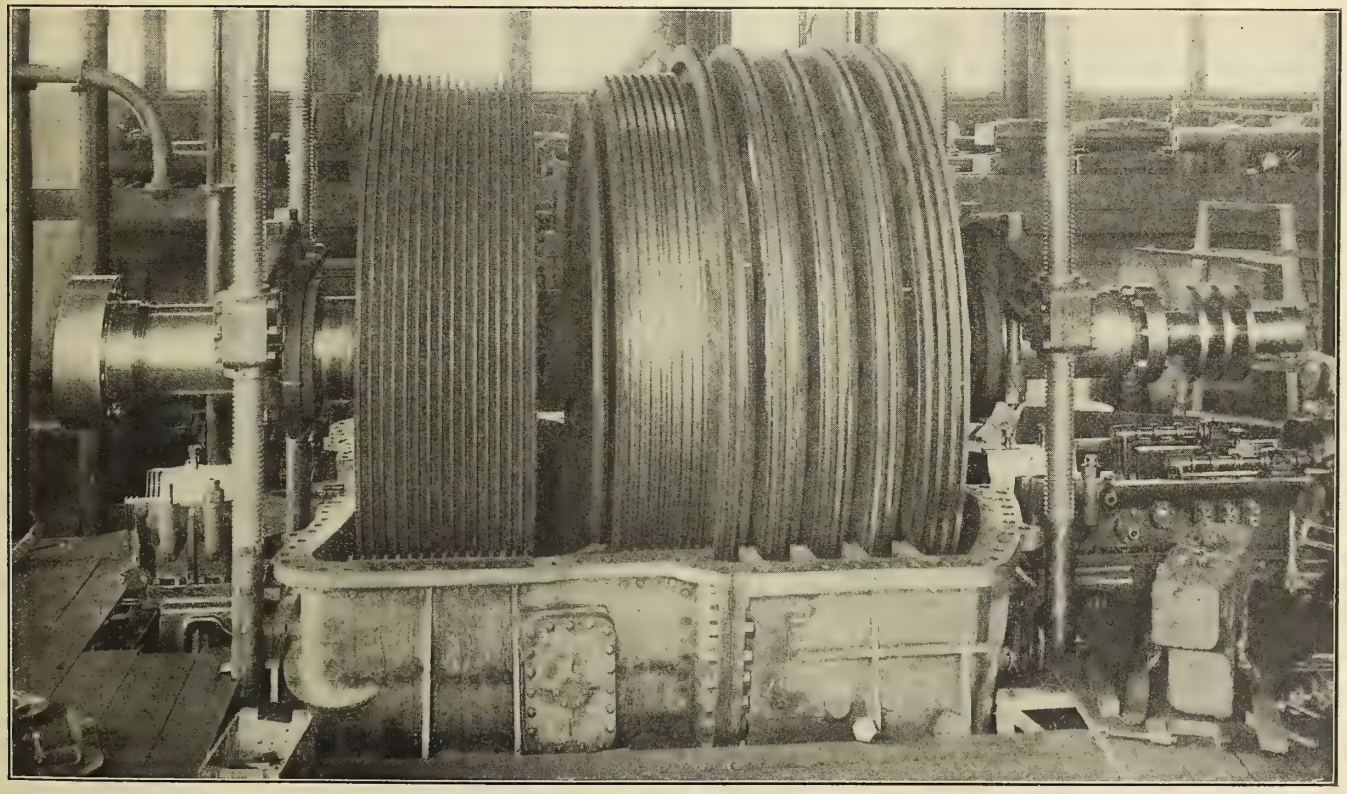


Fig. 4.—High-Pressure Turbine

stage with three moving rows of blades and a drum with eight single row stages. The second stage wheel is integral with the drum.

Steam is supplied to the high-pressure turbine through two 9-inch throttle valves and 9-inch pipes, one leading to each of the full-power steam chests. Steam to the cruising chest is supplied through a 5-inch throttle and a 5-inch pipe. For reversing steam is supplied through a 13-inch throttle and a 13-inch pipe to the after-engine room, where the pipe is divided into two 9-inch pipes, leading to the steam chests on the after end of the low-pressure turbines.

For going ahead with the main turbines only in use steam is supplied to the forward engine rooms through either one or both of the 9-inch pipes or the 5-inch cruising connections to the ahead steam chests, thence through the first, second, third, fourth and fifth wheel stages and the forward drum; thence out through four 11-inch receiver pipes to the steam belt on the after end of the high-pressure turbine and forward through the after drum to the exhaust belt of the high-pressure turbine. From there it exhausts through two 20-inch pipes which combine into one 28-inch pipe and exhaust to the low-pressure turbines. In the after-engine room this pipe divides into two 20-inch pipes which lead to the steam belts on the ahead end of the low-pressure turbines. The steam then passes through the low-pressure turbines to the exhaust belt, thence through the exhaust trunk to the condenser.

When the cruising turbines are in use steam is supplied from the main steam pipe to the cruising turbines, thence to the first stage of the high-pressure turbines, thence through the second, third, fourth and fifth stages, as is the case when operating under the main turbines only. The exhaust from the cruising turbine leads to the first stage of the high-pressure turbine and therefore does no work in this stage. A cruising connection of the high-pressure steam chest is provided, however, so that speeds slightly in excess of those given by the steam that passes through the cruising turbine can be obtained.

The turbine wheels are built up of two steel plate disks riveted to a cast-steel spider. The wheel rims are of forged steel except for the first stage ahead and astern, which are cast steel. The drums consist of cast-steel spiders, forced on and keyed to the rotor shafts, with heads of steel plate and rims of forged steel. The diaphragms are of dished steel plate with cast-steel rims and hubs. Leakage of steam and air around the shaft, where it passes through the casings, is prevented by steam-sealed carbon packing stuffing boxes.

The turbine blades and the distance pieces which separate them are of rolled brass, dovetailed into grooves in the periphery of the wheels and rims. The shrouding for the blades is also of rolled brass. In the high-pressure turbine the length of the blades ranges from 1.46-inch in the first row of the first stage to 1⅞ inches in the third row on the fifth stage, and from 1⅝ inches to 1⅞ inches on the forward drum, and from 2½ inches to 3⅞ inches on the after drum. In the low-pressure turbine the length of the blades ranges from 4⅝ inches in the first stage to 13½ inches in the last stages. In the reverse turbines the blades range from 1.76 inches in length in the first high-pressure stage to 8 inches in the last stage.

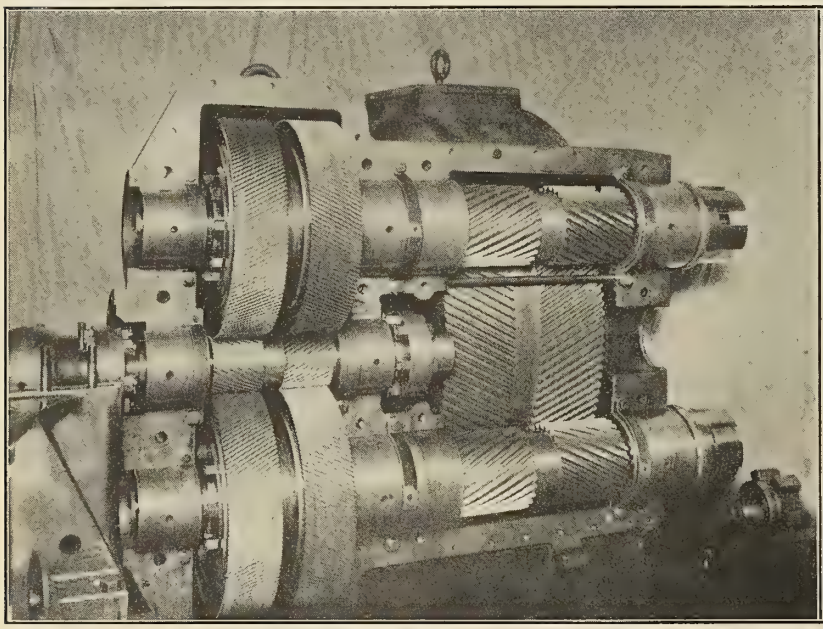


Fig. 5.—Reduction Gear for Cruising Turbine

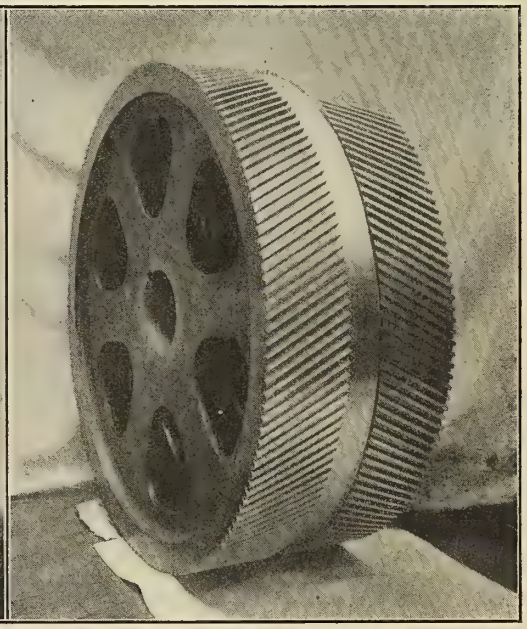


Fig. 6.—Main Gear Wheel

Nozzles for the first stage ahead and the first stage astern are of composition, the openings being accurately machined and filed to template. Nozzles for the second to the fifth stages ahead and the second stage astern are of composition with Monel metal division plates. The nozzles for the first stage ahead and first stage astern are expanding, while all others are parallel wall nozzles.

The cruising turbines and reduction gears were manufactured by the General Electric Company, Schenectady, New York. The turbines are of the three-stage Curtis type, designed to develop 1,750 shaft horsepower at 3,200 revolutions per minute, with steam at 250 pounds gage and exhausting against a back pressure of about 5 pounds gage. All stages in the turbines are wheel stages. The turbines and gears for each of the two shafts are identical and turn in the same direction, but in order to turn the port shaft outboard when going ahead the port unit is turned around and a section of line shafting placed between the main gear shaft and the high-pressure thrust shaft.

The gears are of the double-reduction type, the main pinion of the turbine shaft driving the gears on the two intermediate shafts, while the pinions on the latter drive the main gear wheel. The faces of all pinions and gears

are divided into two parts with the teeth cut at opposite angles in order to balance the thrust. The teeth are cut at an angle of 27 degrees with the axis; both the main and intermediate pinions are forged solid on the sleeve, which fits around the shaft. The intermediae gears are built up, each section consisting of five steel disks securely bolted together. The main gear is of cast iron, with a forged-steel rim in which the teeth are cut.

The propellers are 3-bladed of manganese bronze, cast solid with a diameter of 14 feet 3 inches, a pitch of 12 feet, a projected area of 71.5 square feet, a helicoidal area of 81.5 square feet, a disk area of 159.48 square feet, with a ratio of projected area to disk area of .4483 and of helicoidal area to disk area of .51.

As previously mentioned, steam is furnished at 295 pounds gage pressure by twelve Yarrow watertube boilers, arranged in three watertight compartments. Each boiler has a heating surface of 4,000 square feet with a furnace volume of 625 cubic feet. Oil fuel is used exclusively in firing the boilers, seven Fore River burners being fitted to each boiler. Forced draft is provided by twelve Sturtevant multivane fans in each fireroom. Each fan has a rated capacity of 16,000 cubic feet of air per minute when discharging against a back pressure equal to 5 inches of water and each fan is driven by a direct connected General Electric motor of 32 horsepower.

There is one main condenser in each after-engine room, having a cooling surface of 9,900 square feet, provided with a Blake vertical twinplex single-acting air pump 18½ by 40 by 21 inches. The circulating pumps are of the centrifugal type, with a capacity of about 22,500 gallons per minute, driven by vertical compound reciprocating engines.

Auxiliary condensers of 405 square feet cooling surface each are provided in each forward-engine room with Blake vertical double-acting air pumps, 6 x 10 x 8 inches, and centrifugal circulating pumps driven by a single vertical reciprocating engine. In each forward room there is also a Reilly vertical multicoil feed water heater of 319.8 square feet heating surface for use with the main feed pumps. The main feed pumps are of the Blake vertical double-acting type, while in the after-engine rooms are Blake vertical double-acting single fire and bilge pumps.

The electric plant consists of four 300-kilowatt General Electric generators connected to 2-stage horizontal Curtis turbines. Two of the generators are located in a forward dynamo room and the other two in an after dynamo room. The condensing apparatus for each dynamo room is located directly under the dynamo rooms and a separate distribution room is located directly overhead each dynamo room. Each generator is capable of delivering one-third overload for two hours without injury.

The evaporating and distilling apparatus consists of four Reilly horizontal multicoil evaporators, two Reilly vertical multicoil distillers, two Reilly U-type Bureau standard feed water heaters, two distiller circulating pumps, two evaporator feed pumps and two fresh water pumps together with the necessary accessories. The plant has a rated capacity of 25,000 gallons of water in 24 hours and is arranged to operate in double effect.

Ventilation throughout the ship is provided by forty-eight Sturtevant ventilating fans driven by General Electric motors. Air is supplied on the plenum system and heater boxes are fitted in the ventilating ducts to all quarters below the upper deck, crew's spaces, etc., for heating the incoming air.

The refrigerating plant consists of two horizontal steam-driven Allen condensed air machines, manufactured by H. B. Roelker of New York. Each machine is capable of producing the cooling effect of three tons of ice per day.

The deck machinery includes three motor-driven deck winches, electrical-driven anchor gear and motor-driven capstan, and both steam and electric steering gear, all of which is supplied by the American Engineering Company of Philadelphia.

Trials of Geared Turbine Propelling Machinery on Freight Steamer Pacific

Vessel Equipped with Curtis Five-Stage Geared Turbine of 2,400 Horsepower Supplied with Superheated Steam from Scotch Boilers

The standardization trials of the steamship *Pacific*, recently built by the Union Iron Works, San Francisco, Cal., for Norwegian owners, were held on November 21, 1915, over the measured mile trial course off Bluff point, in San Francisco Bay. This vessel is of special interest at this time, as she is one of the first large general cargo steamers of moderate speed built in the United States to be equipped with geared turbine propelling machinery.

The *Pacific* is 418 feet long over all, 400 feet long between perpendiculars, with a molded beam of 56 feet and a molded depth to upper deck of 32 feet. In light condition, with a draft of 8 feet 3½ inches, the displacement is 3,540 tons, and the tons per inch of immersion 41.17. In loaded condition, with a draft of 25 feet 4 inches, the displacement is 12,500 tons, and the tons per inch of immersion 46.16. The main characteristics of the hull in both the light and loaded conditions are shown in the following table:

	Light	Loaded
Block coefficient	.673	.773
Prismatic coefficient	.712	.790
Area of midship section	435	1,385
Coefficient of midship section	.942	.930
Area of water plane	17,330	19,390
Center of buoyancy above base	4.96	13.8
Transverse metacenter above base	36.4	24.28
Longitudinal metacenter above base	1,890	473

Propulsion of the vessel is by a Curtis 5-stage geared turbine supplied by the General Electric Company, Schenectady, N. Y., and designed to develop 2,400 shaft horsepower at 3,500 revolutions of the turbine and 90 revolutions per minute of the propeller shaft. Steam is supplied at a pressure of 210 pounds per square inch by three single-ended, three-furnace Scotch boilers, 14 feet 9 inches inside diameter and 11 feet long. Each boiler has a heating surface of 2,685 square feet, and is fitted with superheaters of the Union Iron Works Company's type.

The propeller is of the built-up type with a cast iron hub and four composition blades with a diameter of 16 feet 6 inches, a pitch of 14 feet and an expanded area of 77.04 square feet.

The following tables give the pump data and a list of the auxiliary machinery:

Pump Data	
1 Main air pump	Vertical twin beam, 14 ins., 28 ins., 18 ins.
1 Circulating pump	U. I. W. Co.'s centrifugal, 14 ins. dia., 42-in. runner
1 Main feed pump	De Laval turbine, 37 H. P.
1 Auxiliary feed pump	De Laval turbine, 37 H. P.
1 Fire and bilge pump	Duplex horizontal, 12 ins., 8½ ins., 12 ins.
1 Ballast pump	12 ins., 10½ ins., 12 ins.
1 Trimming pump	10 ins., 7 ins., 10 ins.
1 Sanitary pump	7½ ins., 5 ins., 6 ins.
1 Fresh-water pump	7½ ins., 5 ins., 6 ins.
1 Evaporator pump	4½ ins., 2¾ ins., 4 ins.
1 Engine room bilge pump	6 ins., 5¾ ins., 6 ins.
2 Fuel oil pumps	6 ins., 4 ins., 6 ins.

Auxiliary Machinery	
1 Circulating pump engine	10 ins. x 10 ins.
1 Steam tiller	Brown type, 7½ ins x 12 ins.
1 Capstan	8 ins. x 10 ins.
1 Windlass	10 ins. x 16 ins.
11 Winches	Ten 7 ins. x 10 ins.; 1-9 ins. x 12 ins.
2 Generators	G. E. Co.'s 15-horsepower turbine, 10 kilowatt
1 Feed-water heater	U. I. W. Co.'s type
1 Evaporator	12 ton
1 Ice machine	Vulcan Iron Works type

On the standardization trials of the vessels, which were held on November 21, the ship left the builders' wharf at 9:15 A. M., and after the compasses were adjusted, headed for the California city course at 10:05 A. M. The four-hour run was begun at 11 o'clock. Two double runs were made over the course, and then the vessel was headed out for a short run at sea. The four-hour run was finished at 3 P. M., and the vessel landed at the builders' whartf at 4:15. The draft of the ship was 6 feet forward and 16 feet 1 inch aft, making the mean draft 11 feet ½ inch. The fuel oil consumed per shaft horsepower per hour, allowing 10 percent for the auxiliaries, figured out at .83 pound. Referring to the indicated horsepower and allowing 10 percent for the auxiliaries, the fuel oil consumption was .73 pound per horsepower-hour. The data taken on these trials are shown in Table I.

Table I.—Standardization Trials, S.S. Pacific

	Mean of 2 Double Runs Over Measured Mile	4-Hour Trial at Sea
Speed, knots	13.1	.....
Slip, percent	—0.05	.....
Revolutions per minute	89	88.5
Horsepower	2,360	2,355
Boiler pressure, pounds per square inch	207	207
Vacuum, inches	29	29
Temperature, superheated steam, F.	420	420
Temperature, saturated steam, F.	390	385
Temperature of feed water, F.	175	180
Temperature in stack, F.	675	672

On December 13 and 14 the *Pacific* made a voyage from Seattle to San Pedro, and during this voyage the data given in Table II were taken.

Table II.—Data Taken on Voyage From Seattle to San Pedro

	Dec. 13-14	Dec. 14	Dec. 14	Dec. 14
Speed, knots	10.88	11.2	10.5	9.8
Revolutions per minute	85.9	86.	81.	77.
Shaft horsepower	2,450	2,450	2,030	1,725
Boiler pressure, pounds per sq. in.	200	200	200	190
Vacuum, inches	29¾	29½	29½	29½
Temperature, superheated steam, F.	410	....	....	....
Temperature, saturated steam, F.	390	....	....	....
Temperature, feed water, F.	208	205	205	210
Temperature in stack, F.	590	630	630	630
Pounds of oil per shaft horsepower hour, allowing 10 percent for auxiliaries	0.95	0.97	1.001	1.07

While on the trial trip the *Pacific* was carrying only 500 tons load. Some additional data are available, which were taken on a trip from Seattle after the ship had taken on a full cargo of 8,300 tons, the results of which are given in Table III.

Table III.—Three-Hour Full-Load Test at Sea

Speed, knots	11.5
Revolutions per minute	87
Draft of vessel, feet	25
Load, tons	8,300
Steam pressure at turbine, pounds per square inch	207
Vacuum, inches	28
Horsepower, average	2,655
Pounds of oil per brake horsepower-hour	0.875
British thermal units per brake horsepower-hour	16,420

During the trial run in light condition the reduction gears were noisy, but, with the increased draft on the run in full load condition, the operation of the gears, as regards noise, was greatly improved. The complete immersion of the propeller insured a steady load on the gears, with the result that the noise noticeable in the trial test was gradually reduced, so that it was practically unnoticeable anywhere about the ship, and was a matter of no inconvenience even in the engine room. After the trial trip a larger oil cooler was installed, and it is considered probable that the increased quantity of oil which is now being sent through the gears, due to the use of a larger cooler, has a material effect in giving smoothness in the operation of the gears.

From the data given above it will be noted that a speed of 11.5 knots was obtained at 87 revolutions per minute of the propeller, which indicated that the pitch of the propeller is slightly high for the speed and horsepower of the turbines. This will be remedied in future boats by decreasing the propeller pitch to such a point that a speed of 11.5 knots will be secured at about 90 revolutions. This should result in a gain in the efficiency of the propeller and improve the operation of the ship when lightly loaded.

The propelling machinery of the *Pacific* has proved satisfactory in every respect, and the captain and chief engineer of the vessel have been enthusiastic in their praise of the equipment, and consider that the *Pacific* is by far the most economical vessel of its capacity on the Pacific Coast. Considering the fact that this design of the turbo-gear propelling machinery is new throughout and that the machinery was installed in less than ten days, and that the ship was put into commission the day after she was finished, and left immediately on a voyage of several months' duration around Cape Horn, it will be appreciated that the turbine and reduction gears have been given a very severe test. The satisfactory results and the economy gained will, therefore, be of much interest to all steamship owners and should pave the way for a wider adoption of this type of machinery in modern slow-speed vessels.

Successful Installation of Fire-Tube Superheater on a Railroad Tug

The first fire-tube superheater installed on an American boat operating in American waters has just shown that it can effect a saving of 15⅝ percent in coal consumption and gain other advantages for the vessel, as compared with one using saturated steam.

The installation was made on the Lehigh Valley Railroad tug *Wyoming*, a vessel of 398 gross tons, 152 feet long, 27 feet 3 inches beam and 16 feet draft, with a towing capacity of 5,000 tons. Propulsion of the tug is by a triple-expansion engine, with cylinders 17 inches, 25 inches and 43 inches diameter, with a stroke of 30 inches, supplied with steam at a pressure of 180 pounds per square inch by a single Scotch boiler fitted with a fire-tube marine superheater supplied by the Locomotive Superheater Company, New York.

The use of superheated steam in marine practice has been indulged in by European owners quite extensively during the past six years, and the successful results obtained have been responsible for the policy becoming more and more widely adopted. At the present time European owners have over 2,500,000 horsepower afloat in boats equipped with Scotch boilers and high-degree superheaters. In America, however, notwithstanding the fact that industrial plants almost universally employ superheated steam, and over 15,000 locomotives are operating with 225 to 250 degrees of superheat, the marine engineers and shipowners have been somewhat dilatory in accepting the advantages offered by high-degree superheating.

The Lehigh Valley Railroad Company, operating as it does some 238 locomotives equipped with high-temperature superheaters, and appreciating the possibilities offered, recently installed superheater equipment in their tug *Wyoming*. The *Wyoming* has been operating now for three months, using superheated steam, and during that time has been in daily service, towing barges laden with as much as 4,800 tons of coal, between Perth Amboy, N. J., and the New England coast. To ascertain accurately the advantages of the superheater in this boat, its coal was carefully weighed daily and every precaution

Fig. 1.—Lehigh Valley Tug Wyoming

taken to insure that no false results or improper conclusions would be reached. At the end of three months the *Wyoming* showed a saving of 15⅝ percent in fuel as compared with a similar three months in identical service, but using saturated steam.

In addition, the boat has been kept going all the time; in other words, its efficiency in getting coal from New Jersey to New England has been greatly increased.

As noted above, the application of a high-degree super-

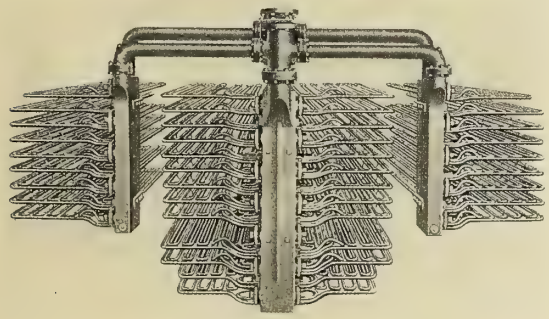


Fig. 2.—Superheater Units Assembled

heater to Scotch boilers in marine service was without precedent on this side of the water, and therefore was looked upon somewhat in the nature of an experiment. The results obtained, however, have corroborated those obtained by a large number of European owners, and the Lehigh Valley Railroad Company has not only announced that the superheater on the *Wyoming* is there to stay, but it is planning to equip the remaining vessels of its fleet as rapidly as conditions will permit.

The boiler plant of the *Wyoming* consists of one four-furnace Scotch marine boiler, 15 feet in diameter and 12 feet long over all, with a distance between the tube sheets of 8 feet 3 inches. This boiler has a total grate area of 86.6 square feet, a boiler evaporative surface of 2,926 square feet, and in addition a superheating surface of 758 square feet.

The fire-tube superheater in the *Wyoming* consists of three pairs of collector castings or headers, located at the uptake end of the boiler, each pair of headers being connected to a group or nest of superheater unit pipes, which run in and out of the boiler smoke tubes. Of each pair of headers one takes the saturated steam as it comes from the boiler and transfers it to the superheater units; the

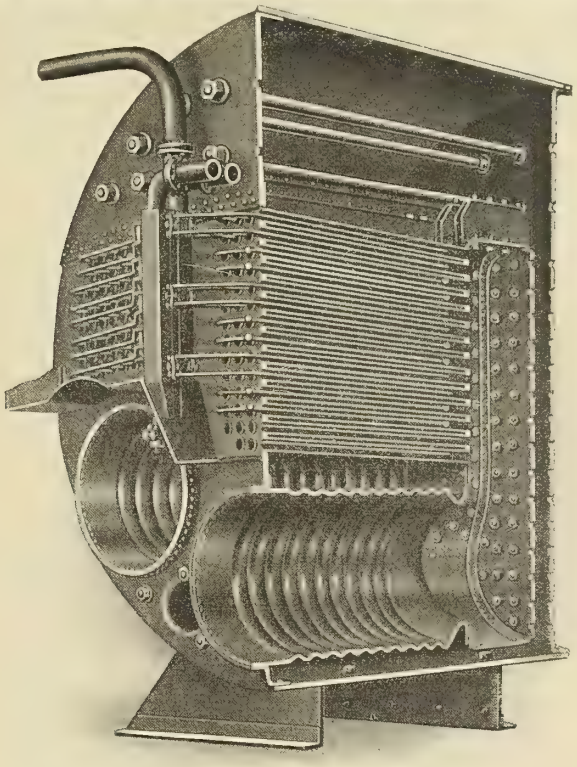


Fig. 3.—Section of Scotch Boiler, Showing Installation of Superheater

other receives the superheated steam after it has passed through the units on its way to the engines.

In this superheater there is a total of 80 units, arranged in three groups, corresponding to the number of pairs of headers. These groups, each made up of a saturated and a superheated header, with a system of units, are independent in their action, being separated from each other by valves, which can be closed if necessary.

The degree of superheat obtained can be governed by a mixing pipe, which cools the superheated steam to any desired temperature by admitting the proper amount of saturated steam to the main steam pipe. The average steam temperature obtained with this superheater is about 565 degrees, which, with a steam pressure of 180 pounds, is equivalent to 185 degrees of superheat. A maximum steam temperature of 620 degrees, corresponding to 240 degrees of superheat, has been successfully maintained for periods of several hours' duration.

In order to operate the power plant with the greatest efficiency, two pyrometers are used to indicate the degree of superheat that is being obtained. One of these instruments is located in the boiler room and is connected in the main steam pipe, near the superheater header, while the other is connected to the main steam pipe just above the throttle in the engine room. By means of these pyrometers the engineer can always know the conditions under which his boilers are operating.

New Luckenbach Freight Steamers

Two Single Screw and Two Twin Screw Vessels to be Propelled by Curtis Geared Turbines

Four large freight steamers are now under construction at the yards of the Fore River Shipbuilding Corporation, Quincy, Mass., for the Luckenbach Steamship Company, New York. All four of these vessels will be driven by high-speed Curtis turbines, driving the propellers through speed reduction gears. Two of the vessels are single screw and two twin screw. The single screw vessels are of 10,000 tons and the twin screw vessels of 10,500 tons deadweight carrying capacity. They are designed for a speed of 13½ knots on a 28-foot draft. The principal dimensions of the single screw vessels are as follows:

Length overall	456 feet
Length between perpendiculars	437 feet 6 inches
Beam, molded	57 feet
Depth, molded	41 feet 6 inches

The twin screw vessels are slightly larger, as shown by the following dimensions:

Length overall	469 feet
Length between perpendiculars	447 feet
Beam, molded	55 feet 11 inches
Depth, molded	40 feet 8 inches

The vessels are built according to designs by Mr. J. L. Luckenbach, vice-president of the Luckenbach Steamship Company, and are classed by Lloyd's and the American Bureau of Shipping.

Propelling Machinery of Single Screw Vessels

The propelling machinery of the single screw vessels is located amidships and consists of a Curtis turbine, driving a high and low speed reduction gear designed to deliver 4,000 shaft horsepower at 90 revolutions of the propeller shaft. The maximum shaft horsepower will be 4,500, with the revolutions of the propeller not exceeding 93.

The turbine is designed to operate with a steam pressure of 195 pounds in the steam chest and against a vacuum of 28 inches.

The turbine is so arranged that the ahead and reverse turbines are carried on one shaft and contained in one casing. The astern turbine will be capable of delivering to the shaft not less than 50 percent of the power of the ahead turbine. The revolving element will be so designed as to stand an overspeed of 20 percent above the full speed.

The total reduction of speed between the turbine and the propeller shaft will be in two steps, the system employed being what is known as the double drive type—that is, the pinion will drive two gears, one diametrically opposite the other, thereby eliminating pressure on the pinion bearings and insuring perfect tooth contact throughout the entire guiding surface of the turbine.

The high speed pinion will be directly connected to the turbine shaft by means of a flexible coupling, so arranged that any actual motion in the gears or pinions will not be transmitted to the turbine shaft. Each wheel will carry a right and left helical gear.

The low speed reduction gear will consist of a large gear wheel driven by two pinions, each pinion being driven through a flexible connection from one of the wheels in the high speed gear casing.

The propeller is 19 feet diameter with the blades set at a pitch of 16 feet. The pitch, however, is adjustable from 15 feet to 17 feet. The propeller hub is made of cast iron fitted to the propeller shaft with a taper and key and held by a forged steel nut. The propeller blades are made of manganese bronze.

Propelling Machinery of the Twin Screw Vessels

In the twin screw vessels the propelling machinery, located amidships, consists of two Curtis turbines driving high and low speed reduction gears, designed to deliver 2,000 shaft horsepower each, at 105 revolutions per minute of the propellers. The total maximum shaft horsepower developed with the revolutions of the propellers not exceeding 109 per minute will be 4,500.

The principal characteristics of the turbines and reduction gears on the twin screw vessels are the same as those for the single screw vessels, as explained above. The propellers, however, are solid, 14 feet 6 inches diameter, made of bronze.

Boilers

On the single screw vessels steam is supplied by three Scotch boilers, each 16 feet 6 inches inside diameter, and 12 feet 3 inches long over the heads, with a heating surface of 3,546 square feet. Each boiler has four Morrison corrugated furnaces, 42 inches inside diameter. The boilers are designed for a pressure of 195 pounds per square inch and work under the heated system of forced draft, for which one Sturtevant multivane blower fan with two engines is located in the engine room. The boilers are arranged to burn fuel oil on the Dahl system, the necessary pumps, filters, heaters, etc., being arranged in the fireroom.

On the twin screw vessels steam will be supplied by four Heine watertube boilers of 15,000 square feet heating surface working under forced draft and burning oil on the Dahl system.

Auxiliaries

The auxiliaries on both the single and twin screw vessels are identical. A main condenser of 5,850 square feet of cooling surface is provided, connected to an air pump of the independent wet and dry twinplex beam type, the necessary cooling water being supplied by a main centrifugal pump of 18 inches diameter directly connected to a 10-inch by 9-inch single cylinder vertical engine.

The necessary pumps, which are of the Blake & Knowles type, the high and low feed water heaters of Griscom-Spencer make, and an auxiliary condenser are located conveniently in the engine room. Abaft of the reduction gear is the thrust bearing, consisting of ten horseshoes with ample wearing surface. The line shafting consists of seven sections with the necessary bearings.

The electric plant consists of two 20-kilowatt General Electric generator sets, driven by reciprocating engines. There is a 2-ton Brunswick refrigerating machine and a Griscom-Spencer evaporating machine of 35 tons capacity.

For handling cargo there are 24 derricks, served by 24 single-drum winches of the Hyde type. The capstan and windlass on the single screw vessels will be supplied by the American Engineering Company, while on the twin screw vessels the capstan and windlass are of the Hyde type. The steering gear is of the Brown tiller type.

The lifeboats are handled under Martin-Freeman davits.

Letters from Marine Engineers

Discussion of the Design and Handling of Marine Engines, Boilers and Auxiliaries—Breakdowns at Sea and Repairs

This department is open to all readers of the magazine for the discussion of affairs in the engine room. All letters published are paid for at regular rates. Your ideas or experiences will be mutually helpful and interesting to other engineers. Write your letter now.

In What Part of a Scotch Boiler Should the Feed Water be Discharged?

This is a question that the writer has never seen answered. No technical book that he has ever read answers it satisfactorily, and he has never seen any article that discussed this question directly. There has been some incidental reference to it in articles dealing with other questions pertaining to marine boilers, but none that related to this matter entirely. It would seem that this question is of sufficient importance to be a subject for discussion in the columns of the INTERNATIONAL MARINE ENGINEERING.

That boiler designers have different ideas on the subject is very evident from the fact that the feed water discharges in various places in this type of boiler. The usual practice is to have the feed water enter the boiler on the side, with an internal feed pipe to carry it to different places in the boiler, varying according to the ideas of the designer. In some cases it is carried down to the bottom of the boiler under the furnaces. In other cases it is carried up over the tubes to the middle of the boiler and discharged just below the water line. In still other cases the water is carried down between the tubes to some point above the furnaces, the distance varying according to the notion of the designer. In two cases that came under the observation of the writer the feed water entered through the top of the boiler and discharged in the steam space.

Undoubtedly the designers have reasons for the various practices in this matter, but the writer is firmly of the opinion that there can be no good reason for discharging the feed water in the steam space of a boiler, therefore he dismisses this practice without further comment.

It has been demonstrated that the water in a Scotch boiler does not circulate in the bottom unless the fires are forced sufficiently to generate steam to probably one-half the capacity of the boiler, therefore it follows that in raising steam the cold water remains in the bottom of the boiler until steam begins to generate fairly rapidly, a fact with which every marine engineer is familiar; also when the engines are stopped and the fires banked so as to generate only sufficient steam for the auxiliaries the water in this type of boiler cools off in the bottom, showing that circulation has ceased. It would seem to the writer that under these circumstances it would be better practice not to discharge cold water in the bottom, cold water being any water that is below the temperature of the water in the boiler.

On the other hand, when the boiler is working almost up to its capacity, as when the engines are running over half speed, and the water is circulating in the bottom, it does not appear to be good practice to discharge the cold water above the furnaces where it meets the rising globules of steam, necessarily impeding the circulation and probably condensing considerable of the steam that has formed. The writer also believes that many cases of chronic foaming in boilers are caused by this practice. In fact, he cured a battery of three-furnace boilers of this disease by extending the internal feed pipes, which discharged the feed water near the top row of tubes, down to the fire line of the middle furnaces.

It has been demonstrated by placing a thermometer at or near the bottom of a boiler that when the water is circulating properly there is very little difference in the temperature of the water in the bottom from that in the top, even when the feed water is discharged in the bottom, showing that the cold water is immediately carried up by the circulation; therefore the writer believes that the proper place to discharge the main feed in a Scotch boiler is at or near the bottom. Further, he believes that the proper place to discharge the auxiliary feed, which is rarely used except when the engines are stopped and the water not circulating in the bottom, is above the furnaces, preferably about half way up to the top row of tubes. As the United States Inspector's rules require the auxiliary feed to enter the boiler through an opening entirely independent from the main feed, this can easily be done. In former years the almost universal practice was for both feeds to enter the boiler through the same opening and discharge through the same internal feed pipe.

The writer of this article does not claim to be an expert in any sense of the word, simply a practical marine engineer who has had considerable experience with this type of boiler, and who has reasoned this matter out solely from this experience, he having no knowledge of any treatise on the subject by experts. He would be pleased to hear the views of practical engineers and experts on this question.

J. S.

Graphical Determination of Particulars for Spiral Springs

In marine work the formula generally used to determine the size of steel wire for spiral springs having a mean diameter D and subject to a total load W, is:

$$d = 3\sqrt{\frac{D.W.}{c}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where d = diameter of round or size of square steel in inches,
c = 15,000, 11,000, or 8,000, according to shape of section and the requirements to be worked to.

To obtain the number of free coils N, when the above data are known, and the compression C decided upon, it is usual to adopt the notation:

$$C = \frac{N.W.D^3}{d^4 a}, \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

where d = size of wire in 1/16 inch.
a = 26 for round (British Admiralty), 22 for Board of Trade.
a = 32 for square (British Admiralty), 30 for Board of Trade.

The several forms of equations 1 and 2 all lend themselves readily to graphical solution and, if plotted to specially selected scales, the graphs take the form of straight lines. To anyone who has a number of springs to design for different duties a graph which will enable him, with a little calculation, to ascertain the particulars re-

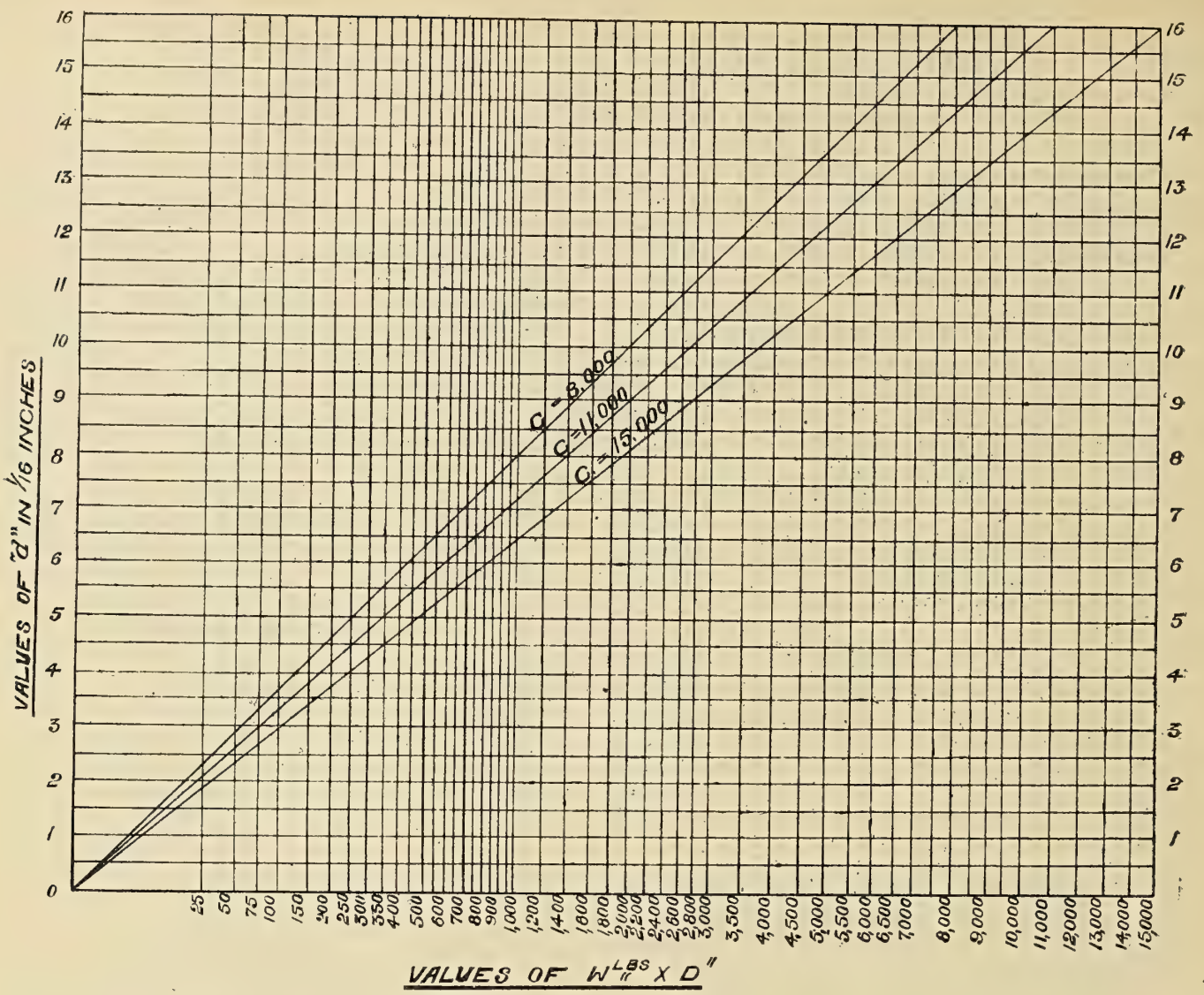


Fig. 1

quired, may be the means of saving much time and trouble. Besides, he is able to see immediately how the alteration to any one quantity will affect the final result without wading through a string of figures.

Fig. 1 gives the relation between d in sixteenths of an inch and $D \times W$ in inches and pounds. By interpolating from the graph the size of wire, given by equation 1, for any of the values of c may be obtained.

Fig. 2 represents the relation between D inches and N/C number of coils per inch of compression for sizes of d from ¼ inch to 1 inch, advancing by one-sixteenth of an inch. This set of curves, however, only covers the equation 2 for one value of a, that of 32. Moreover, since it is constructed on the base of the stress imposed upon the steel by equation 1 it is only correct for the value d where the constant $c = 15{,}000$. Nevertheless, it is quite a simple operation to correct the graph for any value of "c" and "a," all that is necessary being to multiply the number representing $\frac{N}{C}$ from the graph by

$$\frac{15{,}000}{32} \times \frac{a}{c}.$$

A few values of these are given below the graph.

It should be noted that in Fig. 2 the mean diameter D relating to the lines sloping from right to left will be found on the top of the graph, the base being reserved for those pertaining to the curves of an opposite slope.

An example illustrating the use of the curves may serve to elucidate any point which is not quite clear.

It is required to determine the particulars of a safety-valve spring to Board of Trade requirements, the following particulars being known:

Total load on spring	=	1,555 pounds.
Mean diameter of coils	=	2¼ inches.
Compression	=	¾ inch.
Constant c	=	11,000
Constant a	=	30
$W D = 1{,}555 \times 2.25$	=	3,499

From curve $c = 11{,}000$ (Fig. 1) read on line $W D = 3{,}500$ $d = 10.75$ sixteenths of an inch, *i. e.*, $d = 43/64$.

On Fig. 2, where the line of mean diameter 2¼ would cross the line $d = 10.75$, read $\frac{N}{C} = 18.5$ coils.

Therefore, $N = 18.5 \times ¾ \times 1.28 = 13.9$ free coils.

Note that 1.28 is obtained from table below Fig. 2.

It should be borne in mind that since Fig. 2 is constructed on the base of the stress imposed on the steel by Fig. 1, the size obtained from Fig. 1 must be maintained to within 1/64 inch for correct results.

Newcastle-on-Tyne. ARTHUR HOARE.

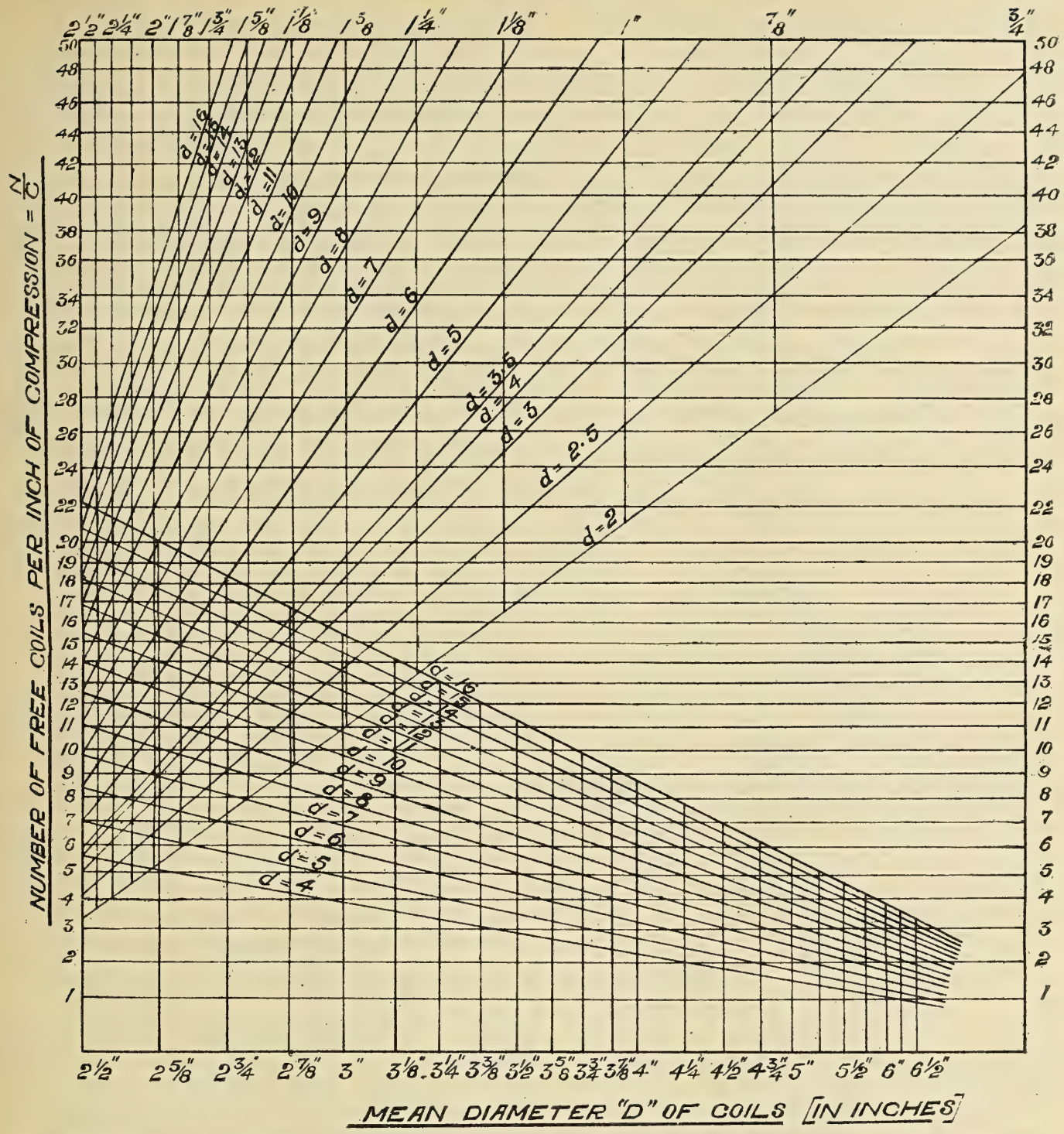


Fig. 2.—Use Curves* Sloping from Right to Left for Mean Diameters up to 2½ Inches, and Those Sloping from Left to Right for Mean Diameters from 2½ to 6½ Inches

* Table of Constants:

Value of C	Value of a	Correct Value of N = N (From Curve) ×
11,000	26	1.11
11,000	30	1.28
11,000	32	1.36
8,000	22	1.29
8,000	26	1.52

Statical Stability at Small Angles

At a very small angle of inclination, the size of the righting area or $G\ Z$ of a ship is given by the expression:

$$G\ Z = G\ M \sin \theta.$$

The theorem of the statical stability of a wall-sided vessel indicates that the height of metacenter above center of buoyancy, or $B\ M$, has a great influence. This theorem is as follows, the figures representing respectively a ship whose sides are vertical all fore and aft and an enlarged representation of the emerged wedge:

Area of triangle $O\ A\ B = ½\ y^2 \tan \theta$.
Lever about vertical $X\ X = O\ F$.
Moment about vertical $X\ X = O\ F \times ½\ y^2 \tan \theta$.
But $O\ F = (O\ E + E\ F)$.
$= (O\ E + A\ C \sin \theta)$.
$= (y \cos \theta + ½\ y \tan \theta \sin \theta)$.
$= \left(y \cos \theta\ (1 + ½\ y \tan \theta) \dfrac{\sin \theta}{\cos \theta} \right)$
$= y \cos \theta\ (1 + ½ \tan^2 \theta)$.
Substituting Moment of Triangle about vertical $X\ X$
$= y \cos \theta\ (1 + ½ \tan^2 \theta) \times ½\ y^2 \tan \theta$.
$= ½\ y^3 \sin \theta\ (1 + ½ \tan^2 \theta)$.

Total moment of emerged and immersed wedges

$$= I \sin\theta\,(1 + \tfrac{1}{2}\tan^2\theta)$$

where I = transverse moment of inertia of waterplane in upright position.

This is = volume $\times B\,R$.

Therefore

$$B\,R = \frac{I}{V}\sin\theta\,(1 + \tfrac{1}{2}\tan^2\theta),$$

$$= B\,M \sin\theta\,(1 + \tfrac{1}{2}\tan^2\theta),$$

and $$G\,Z = B\,M \sin\theta\,(1 + \tfrac{1}{2}\tan^2\theta) - B\,G \sin\theta.$$

$$= \sin\theta\,(B\,M + \frac{B\,M}{2}\tan\theta - B\,G).$$

$$= \sin\theta\,(B\,M + \frac{B\,M}{2}\tan^2\theta)$$

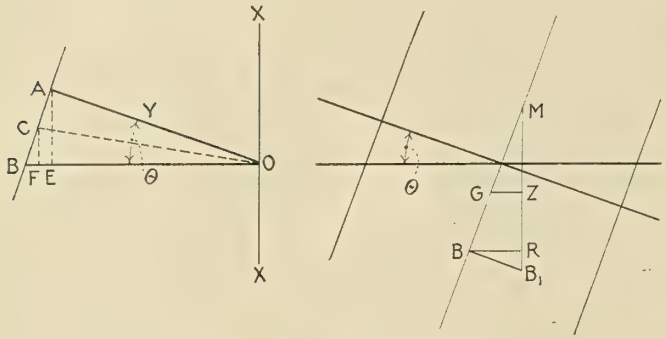


Fig. 1

This expression contains the increase in $G\,Z$ over the value given by $G\,M \sin\theta$; it may be written:

$$G\,Z = G\,M \sin\theta + \frac{B\,M}{2}\tan^2\theta \sin\theta,$$

the latter part being the increase.

Divergence in $G\,Z$'s of actual ships, from the values obtained by this formula is due to the sloping nature of shipshape transverse sections. At small angles, however,

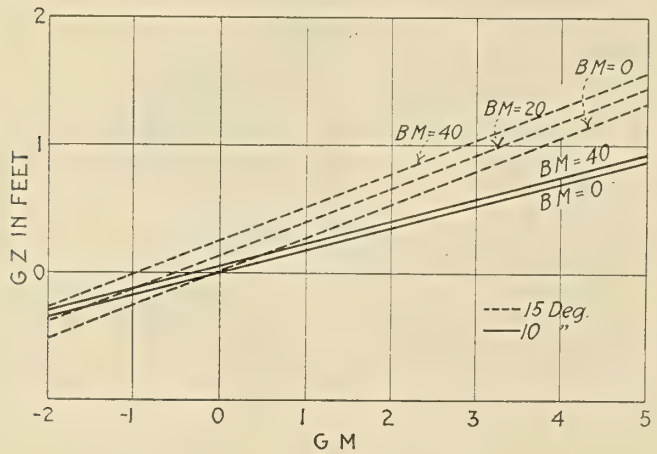


Fig. 2

it is possible to get values for the righting lever of ship forms by the employment of diagrams based on the $G\,M$ and $B\,M$ of the upright position.

Up to an inclination of about 30 degrees, provided the ratio of beam to draft is not abnormally great, and also that the deck edge has not previously entered the water, the diagrams appended will be found to give close approximation to $G\,Z$'s enabling the naval architect to draw the lower end of the statical stability curve. At 10 degrees, 15 degrees, or even 20 degrees, the values are reliable enough to replace the results of the usual lengthy calculations, and the 30-degree lines supply at least a valuable check. It would not have been of any service to give a diagram based on the same factors for 45 degrees, as the deck edge is usually immersed long before this inclination has been reached. The variations in the angles at which this occurs in different ships and the effect of superstructures would obviously make such a diagram useless for practical purposes.

A use to which these diagrams may be put is to predict the angle of heel at which a vessel with a small negative $G\,M$ would lie, assuming no water ballast used to lower "G" and correct this tendency. This sometimes occurs in vessels without coal, cargo, etc., on board, such as liners, where it is desirable to have a small positive

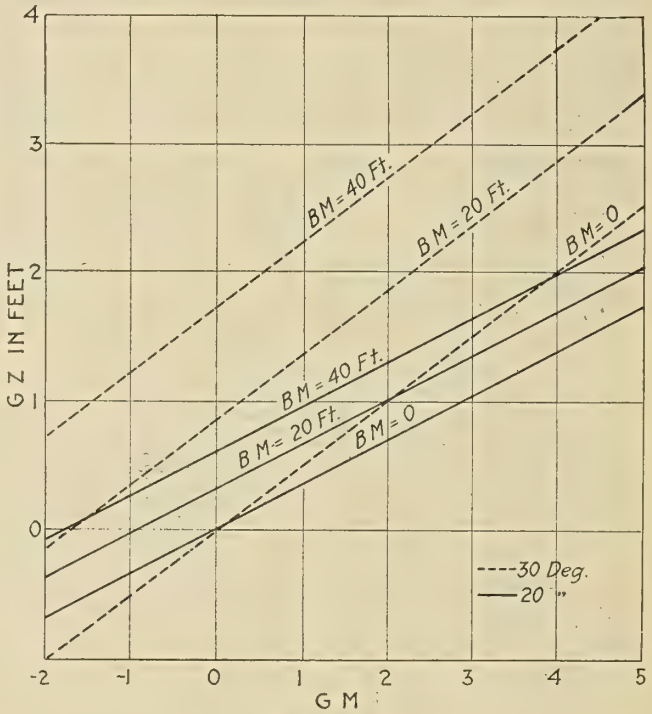


Fig. 3

$G\,M$ with all cargo on board to insure easy rolling, resulting in the necessary adoption of a negative value for the unloaded condition.

An example will illustrate the procedure: A liner has an estimated $G\,M$ of —0.45 feet and $B\,M$ of 16.5 feet

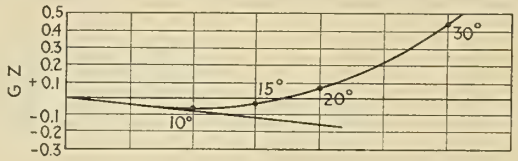


Fig. 4

with no cargo, etc., on board. If the draft has to be kept to a minimum for some purpose, so that water ballast may not be used, to what angle will the vessel "loll"?

From the diagrams the $G\,Z$'s are obtained as tabulated below:

Angle	10°	15°	20°	30°
$G\,Z$.....	—.06	—.03	+.07	+.45

If this is plotted as shown in the figure, it will be seen that at the angle of 17 degrees the $G\,Z$ becomes positive, increasing rapidly in amount and giving the vessel comparatively great stability beyond this angle. PETER DOIG.

Questions and Answers for Marine Engineers

Inquiries of General Interest Regarding Marine Engineering and Shipbuilding will be Answered in this Department

CONDUCTED BY H. A. EVERETT *

This department is maintained for the service of practical marine engineers, draftsmen and shipbuilders. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so. Indicator cards taken from marine engines will be carefully analyzed, the defects pointed out, and the horsepower calculated, provided complete data are sent with the cards.

Consumption of Lubricating Oil for Gasoline (Petrol) Engine

Q.—What is a reasonable consumption of lubricating oil for a 10-horsepower gasoline (petrol) engine?

A.—A moderate consumption is about 0.008 pint per brake horsepower per hour. This would be about 0.08 pint per hour for the engine cited.

Relative Calorific Values of Gasoline (Petrol) and Kerosene (Paraffin)

Q.—Can you tell me whether the power available in kerosene (paraffin) is equal to that available in gasoline (petrol)? Would I get as much power from my engine if I operated with kerosene (paraffin) as gasoline (petrol)?

A.—The average calorific values of gasoline (petrol) and kerosene (paraffin) are about the same, from 20,000 to 21,000 B. T. U. per pound, with a shade the higher values for gasoline (petrol). If you obtain proper carburetion there should be but little difference in horsepower of output using either.

Type of Turbines on the Vaterland and Imperator

Q.—What is the type of turbines on the steamship *Vaterland* and *Imperator?* G. N.

A.—The turbines of the *Imperator* and *Vaterland* are a combination of the Curtis and Parsons or, more properly stated, of the impulse and reaction types. This is a combination which is now quite common and exists largely from the desirability of avoiding small tip clearances at the high-pressure end. This is fulfilled by first passing the steam through several wheels of the impulse type with an attendant large pressure drop and then continuing the steam on through blading of the Parsons type. In the *Vaterland* and *Imperator,* which are each equipped with four turbines totaling 62,000 shaft horsepower, the two center shafts are equipped with the high-pressure turbines and the wing shafts with the low-pressure turbines. In the high-pressure turbines a Curtis wheel, provided with three or four rims of buckets, is placed in front of the drum; in the intermediate turbines a Curtis wheel, fed directly with boiler steam, is mounted on the drum. The drum blades are reaction buckets.

How to Figure Horsepower of Janney-Williams Motor

Q.—Will you kindly explain how to obtain the horsepower of a machine such as the Janney-Williams motor from the dimensions of the engine? Which part of the hydraulic pressure on the pistons is used for the turning moment? Could you give a diagram of the resolution of forces acting on the inclined structure? Such information would greatly oblige an old subscriber. I. T.

A.—Probably the easiest way of determining the capacity of a given unit is to figure the horsepower that the constant speed shaft can reasonably transmit; for example, the unit which has a constant speed shaft of 1¾ inches is rated to operate at about 625 revolutions per minute, and at this speed a steel shaft of this size usually carries power according to the following formula (Unwin "Machine Design," Part I):

$$d = \sqrt[3]{\frac{63{,}024}{0.196\, f_s}} \quad \sqrt[3]{\frac{HP}{N}},$$

where HP = horsepower transmitted.
N = number of revolutions per miuute.
f_s = greatest safe stress for the material of the shaft.
d = diameter of shaft in inches.

For alternating stress and good steel

$$\sqrt[3]{\frac{63{,}024}{0.196\, f_s}} = 4.4,$$

so that

$$1.75 = 4.40 \sqrt[3]{\frac{HP}{625}}, \text{ and } HP = 39.3,$$

which is about what this unit is rated at.

The inclined plane is essentially a stroke-regulating device for the hydraulic pistons and a force diagram is unnecessary, as for one revolution the load on the pistons multiplied by their stroke is equal to the torque at the radius of the control disk multiplied by its circumference. The constant speed or driving end operates the first set of pistons at total strokes, which are direct functions of the angularity of the control disk and, therefore, neglecting leakage, the quantity of fluid pumped to the second chamber varies in this proportion. As the second set of pistons is arranged with a constant angularity of control disk and, therefore, constant stroke, the varying quantity sent from the first chamber results in revolutions of the driven shaft, which are directly proportional to this quantity.

Horsepower varies as pressure × quantity pumped, therefore, as pressure × revolutions per minute × stroke (for driving end) and as a similar expression for the driven end. For the driven end the *stroke* is constant and for the driving end the *revolutions per minute* are constant, so that the *revolutions per minute* of the driven end are directly proportional to the stroke of the driving end if we assume the same allowable hydraulic pressure for both chambers. The stroke of the driving end is

$S :: D \cos \Theta$ where D = diameter of control disk.
S = stroke.
Θ = angle between disk and shaft.

From the above it is evident that horsepower is proportional to pressure × revolutions per minute × $D \cos \Theta$; so if we assume an allowable pressure (approximately 800 pounds per square inch), revolutions per minute and angle of disk the horsepower transmitted can be computed by taking account of the actual dimensions.

Books on Propeller Design

Q.—Kindly recommend through your queries department some good text book covering design and laying out of marine propellers. E. W. O.

A.—The best books available upon propeller design are "Speed and Power of Ships," by D. W. Taylor, and "The Screw Propeller," by Dyson. These are both elaborate

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treatises, and are expensive books. The best moderate-priced book is "Propellers," by C. H. Peabody. This is based upon the experimental investigations of Taylor and has an excellent treatment of the general question of powering and propeller design.

Calorific Value of Coal

Q.—Is there any way whereby the calorific value of a coal can be readily determined if I know its chemical analysis? Chief.

A.—The American Society of Mechanical Engineers in their code for boiler testing recommend the following formula:

$$\text{B.T.U. per pound of coal} = 14{,}600\,C + 62{,}000\left(H - \frac{O}{8}\right) + 4{,}000S$$

where C, H, O and S are the proportionate parts by weights of carbon, hydrogen, oxygen and sulphur. Take for example a coal of the following composition (Pocahontas run of mine):

$C = 85.4$ percent. $H = 4.39$ percent. $O = 3.94$ percent. $S = 0.62$ percent.

B. T. U. $= 14{,}600 \times .854 + 62{,}000 \times .039 + 4{,}000 \times .006 = 14{,}912$. As tested by calorimeter this coal had actually a calorific value of 14,906.

Volume of Compressed City Gas for a Tank

Q.—(1) How many thousand cubic feet of city gas would a seamless steel tank 12 inches diameter and 36 inches long contain at a pressure of 500 pounds per square inch?

(2) How many cubic feet of gas will a boiler burn per hour from a grate area of 20 square feet running full blast? T. G.

A.—(1) The characteristic equation for a perfect gas is $PV = RT$, where P = pressure in pounds per square foot, V = volume of 1 pound in cubic feet, T is the absolute temperature (Fahrenheit temperature plus 459.5 degrees) and R is the so-called gas constant, a constant which varies for different gases but which remains the same for a given gas. A reasonable value for R for the average illuminating gas as used in American cities is about 135, so that the equation becomes for this case $PV = 135\,T$. For this problem V is the characteristic desired, P is given as $500 \times 144 = 72{,}000$ pounds per square foot and assuming normal atmosphere temperature of 60 degrees F,

$$T = 60 + 459.5 = 519.5 \text{ degrees.}$$

$$V = \frac{135 \times 519.5}{72{,}000} = .974 \text{ cubic foot.}$$

The volume of the tank is

$$\frac{\pi \times 1^2 \times 3}{4} = 2.36 \text{ cubic feet,}$$

so there could be put into the tank at the pressure given $2.36 \div .974 = 2.42$ pounds, approximately. As supplied in city mains, the gas pressure averages about 1 inch water, which is 5.2 pounds per square foot, so that the pressure under which the gas goes through the meter is $5.2 + 14.7 \times 144 = 2{,}120$ *pounds per square foot.* The specific volume at this condition and at a temperature of 50 degrees Fahrenheit (as the mains are usually cooler than the supply tank) is

$$V = \frac{135 \times 510}{2{,}120} = 32.5 \text{ cubic feet.}$$

The total amount drawn through the meter and stored in the tank will, therefore, be

$$32.5 \times 2.42 = 78.6 \text{ cubic feet.}$$

(2) The estimate should preferably be made using the heating surface of the boiler instead of the grate surface, but an approximate determination can be made as follows: If we assume that the boiler could be forced to a combustion of 25 pounds of coal per square foot of grate per hour using coal of a calorific value of 14,000 B.T.U. per pound, we would have generated $25 \times 14{,}000 \times 20 = 7{,}000{,}000$ B.T.U. per hour over the entire grate. Ordinary illuminating gas has a calorific value of about 550 B.T.U. per cubic foot, so there would be necessary $7{,}000{,}000 \div 550 = 12{,}750$ cubic feet per hour to give the equivalent heat.

Horsepower of Stern-Wheel River Boats in Up Stream and Down Stream Runs

Q.—It is noted with our stern-wheel, shallowdraft river boats, that when running up stream the revolutions per minute of the engine are greater than when running with the current; cut-off, steam pressure, position of throttle, depth of water, and, in fact, all conditions being the same. Indicator cards taken when running up and down stream show same area and mean effective pressure. As the revolutions per minute are more up stream than down, what connection should be applied to the revolutions per minute when working out indicated horsepower. It is evident that the indicated horsepower is really the same, but on using the revolutions per minute, which are different in each case, the indicated horsepower computed will, of course, be different. In the case of cards taken up stream only, how can one determine the actual indicated horsepower?

In working out slip (actual), $S = \frac{PR - (V - .2\,V)}{PR}$, should the mean speed and mean revolutions per minute up stream and down stream be used? W. M. M.

A.—The indicated horsepower is the product of the piston speed by the mean effective pressure and by the piston area, all divided by 33,000, and it is essential that the revolutions per minute existing at the time the indicator diagram was taken be used in the computation, so there should be no correction for revolutions per minute applied as you suggest. If the revolutions per minute are greater up stream than down with engine conditions the same, it may be due to difference in hull conditions, such as less cargo, or possibly current condition; but in any case the correct procedure is to take the revolutions per minute which existed at the time the diagrams were taken for computing the indicated horsepower. You will very likely find that though the revolutions per minute may increase the mean effective pressure from the cards will decrease so the resultant indicated horsepower will be but little different.

As to slip, it would be preferable to work out the slip independently for the two conditions, for the same reason as above stated. The formula which you quote for real slip assumes a 20 percent wake, which is only an approximation, though it probably treats both conditions alike. The fundamental relationship between real and apparent slip is as follows:

when S is real slip
S' is apparent slip
w is wake
v is speed of ship, feet per minute
P is pitch of propeller (πD for stern wheelers)
R is revolutions per minute

$$S' = \frac{PR - v}{PR}$$

$$1 - S = (1 - S')\,(1 - w)$$

Substituting the value of apparent slip and reducing we get

$$S = \frac{PR - (v - wv)}{PR}$$

which is the same as that quoted if we assume a 20 percent wake.

Argentine Battleships Accepted.—After satisfactorily fulfilling a guarantee of one year's active service the battleships *Rivadavia* and *Moreno,* which were built in the United States, have been accepted by the Argentine Government. The *Rivadavia* was built by the Fore River Shipbuilding Corporation, Quincy, Mass., and the *Moreno* by the New York Shipbuilding Company, Camden, N. J.

Shipbuilding and General Marine News

**Contracts for New Ships—Marine Terminal Improvements—
Recent Launchings — Improved Appliances — Personal Items**

Definite announcement has been made that the Bethlehem Steel Company will soon authorize the expenditure of from $15,000,000 (£3,080,000) to $20,000,000 (£4,100,000) for the extension of the newly acquired plant of the Maryland Steel Company at Sparrows Point, Md. That the shipbuilding facilities of the Maryland Steel Company will be greatly enlarged seems certain in view of the present condition of the market for new vessels.

Closely following the announcement made last month of the acquisition by the New York Shipbuilding Company and the Newport News Shipbuilding & Dry Dock Company of the rights to manufacture in the United States the Werkspoor type of Diesel engine, the announcement is now made that the William Cramp & Sons Ship & Engine Building Company has acquired the exclusive rights in this country for the manufacture of the Burmeister & Wain Diesel engine for marine purposes. With the three largest shipyards in the country equipped for the building of large motor ships and with over twelve other firms either already engaged or about to begin the manufacture of heavy oil engines for installation in marine vessels, it is very apparent that the era of the motor ship is safely launched in the United States.

Contracts for New Ships

The Seattle Construction & Dry Dock Company, Seattle, Wash., has received a contract from the Luckenbach Steamship Company for the construction of a 10,000-ton freight steamer to be fitted with geared turbo electric propelling machinery. The vessel is to be delivered in seventeen months.

W. R. Grace & Co., New York, have placed an order for two more steamships with the Wm. Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa. Presumably these ships will be 6,300 gross tons, as are the two already under contract with the Cramp Company.

The Coastwise Transportation Company, Boston, Mass., has placed contracts with the New York Shipbuilding Company, Camden, N. J,, for two colliers. This order is in addition to two ships already under contract in the same yard.

The Pittsburg Steamship Company, Cleveland, Ohio, has ordered two of the largest size lake carriers from the American Shipbuilding Company, Cleveland, Ohio.

The Western Dry Dock & Shipbuilding Company, Port Arthur, Ont., has received contracts for the construction of two ocean-going freight steamships.

The Union Iron Works, San Francisco, Cal., has received a contract to build two oil tankers 435 feet long for the Atlantic Refining Company, Point Breeze, Philadelphia, Pa.

The New York Shipbuilding Company, Camden, N. J., has received a contract from the Darrow-Mann Company, Boston, Mass., to build a collier of 9,000 tons carrying capacity.

The Toledo Shipbuilding Company, Toledo, Ohio, will build four steamers for Norwegian owners.

The Maryland Steel Company, Sparrows Point, Md., has received a contract from Captain Christoffer Hannevig, care of Hannevig & Johnsen, New York, to build a 4,000-ton freight steamship. Captain Hannevig is general manager of the Trans-Atlantic Motor Ship Company, Ltd., Christiania, Norway.

The Maryland Steel Company, Sparrows Point, Md., will build two ore steamers for the Pennsylvania Steel Company, Philadelphia, Pa.

The Texas Company, New York, has ordered plates for the construction of four 10,000-ton oil tank steamships to be built at the yard of the Arthur Sewell Shipbuilding Company, Bath, Maine, which was recently leased by the Texas Company.

The Bath Iron Works, Bath, Maine, has received a contract to build a 240-foot steam yacht for John N. Willys, president of the Willys-Overland Company, Toledo, Ohio. This yacht has been designed by Cox & Stevens, New York.

The St. Helens Shipbuilding Company, St. Helens, Ore., will build a three-masted wooden schooner, to be equipped with oil engines, for Captain William Wrightson, of the Kirby Lumber Company, Mobile, Ala.

The McKay Shipbuilding Company, East Boston, Mass., will build a 218-foot wooden passenger steamboat for the Nantasket Steamboat Company, Boston, Mass.

The Clinton Shipbuilding & Repair Company, Philadelphia, Pa., is building a steel hull floating derrick for the Newton Supply Company, Philadelphia, Pa.

The Townsend Marine Railway Company, Boothbay Harbor, Maine, was the lowest bidder for the construction of a single-screw wooden steamer to be built for the Department of Fisheries, Washintgon, D. C.

The American Shipbuilding Company, Cleveland, Ohio, has received contracts from Norwegian companies to build seven steamships for use in the coasting trade abroad.

The Manitowoc Shipbuilding Company, Manitowoc, Wis., has received a contract to build six ships of Welland Canal size for Norwegian owners.

It is reported that the Chester Shipbuilding Company, Chester, Pa., has closed contracts to build six additional steamers, thus giving it orders for a total of eight vessels.

The Seattle Shipbuilding & Dry Dock Company, Seattle, Wash., has received contracts from foreign companies to build three steel freight ships of about 7,500 tons capacity each.

The Great Lakes Engineering Works, Detroit, Mich., has received a contract from the Buffalo Steamship Company, Buffalo, N. Y., to build an ore steamship of 12,000 tons carrying capacity.

The Union Iron Works, San Francisco, Cal., has received contracts from Norwegian companies to build two oil tank steamships capable of carrying 80,000 gallons each. This makes nineteen steamers now building or under contract at the yard of the Union Iron Works.

The Tampa Foundry & Machine Company, Tampa, Fla., has received a contract from the Central Hudson Steamboat Company, Newburgh, N. Y., to build a steamboat 215 feet long, with 48 feet beam.

Cobb, Butler & Company, Rockland, Maine, has received a contract from the Boston Sand & Gravel Company, Boston, Mass., to build a 185-foot steam lighter.

Owen Lantz, Gloucester, Mass., will build a 108-foot oil-engined fishing boat for John Chisholm & Son, Gloucester.

Crowell & Thurlow, Boston, Mass., are contemplating placing orders for two more steamers.

It is reported that the Moore & Scott Shipbuilding Company, San Francisco, Cal., has taken contracts for two more steamers.

Charles Parkhurst & Son, Gloucester, Mass., are building a 92-foot wooden fishing steamer for Captain John Seavey.

William H. Baldwin, New Baltimore, N. Y., is building a 75-foot wooden tug for Captain Hawley, of New Baltimore.

The Mathis Yacht Building Company, Camden, N. J., is building a 120-foot wooden passenger boat to be propelled by two 150-horsepower Diesel oil engines.

Three coastwise steamers owned by the Boston & Virginia Steamship Company are to be converted into tank steamers for transporting oil in bulk. Each vessel will be lengthened about 50 feet.

The Moore & Scott Iron Works, San Francisco, Cal., has received a contract from G. W. McNear, New York, for the construction of a steel steamer 379 feet long by 52 feet beam of 7,200 tons deadweight carrying capacity.

Contracts Pending

Contracts are pending for building twenty-five to thirty steamships, the delay being due to difficulty in securing steel deliveries.

J. W. Millard & Bro., New York, have made designs for a 215-foot, steel-hull freight and passenger steamship for Hudson River service.

The Navy Department, Washington, D. C., opened bids on February 16 for the construction of two seagoing submarines.

Cox & Stevens, 15 William street, New York, are preparing designs for a 260-foot steam yacht for C. K. G. Billings, 30 East Forty-second street, New York.

The Gaston Williams & Wigmore Steamship Company has been incorporated at Wilmington, Del., with an authorized capitalization of $5,000,000. The head offices of the company are 140 Broadway, New York. The company is organized to own and build vessels for use in foreign trade, particularly the Far East. The company already owns several vessels and is in the market to purchase or build more.

Shipyard Changes and Improvements

The Maryland Steel Company, Sparrows Point, Md., has become a subsidiary of the Bethlehem Steel Corporation and an immediate expansion of its shipbuilding facilities is expected.

Charles M. Schwab, of the Bethlehem Steel Works, South Bethlehem, Pa., has purchased the plant of the United Engineering Works at Alameda, Cal. Extensive improvements are planned, including building slips where large merchant vessels can be laid down. The yard will be operated as part of the Union Iron Works, San Francisco.

Captain Christoffer Hannevig, care of Hannevig & Johnsen, 80 Broad street, New York, is reported to have bought the shipyard of the Pusey & Jones Company, Wilmington, Del., and it is understood that he is going to use the yard for building schooners, fitted with either steam or oil engines.

Samuel L. Moore & Sons Corporation, Elizabeth, N. J., which has taken over the old Crescent Shipyard, has placed a contract for its new foundry building, and will shortly be in the market for machinery.

The Anderson Steamboat Company, Seattle, Wash., will construct a floating dry dock and enlarge its shipbuilding yards at an estimated cost of $500,000 (£102,500).

D. E. Skinner and C. B. Kamont have organized the Skinner & Eddy Shipbuilding Corporation at Seattle, Wash., and it is reported that the construction of two freight steamers will be begun at an early date.

Johnson & Lanteri, Pittsburg, Cal., contemplate adding to their shipyard a marine railway to have a hauling-out capacity of 2,500 tons. This firm also contemplates enlarging its plant so as to build steel hulls.

It is reported that the Scottish-Mexican Oil Company, 50 Broad street, New York, has taken over the old Marvel Shipbuilding yard at Newburgh, N. Y., and will build a number of oil barges.

The Northern Transportation Company, of Baltimore, Md., has been incorporated in the State of Delaware, with a capital stock of $1,500,000 (£308,000), to construct and operate steamers of all kinds. The incorporators are John T. Donohue, John T. Donohue, Jr., Thomas J. Donohue and Wm. L. Donohue, all of Baltimore.

The Tank Shipbuilding Corporation has been incorporated in New York, with a capital stock of $800,000 (£164,000), to engage in building ships. The incorporators are P. A. Walter, J. G. Deane and H. W. Acton, 120 Broadway, New York.

Burmeister & Wain Diesel Motor to be Built in America by the William Cramp & Sons Ship and Engine Building Company

It will be of interest to shipowners to learn that the William Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa., has recently acquired from Messrs. Burmeister & Wain, of Copenhagen, Denmark, the rights to build the Burmeister & Wain Diesel marine motor in the United States. The Danish company has been phenomenally successful with this engine, specializing principally on cargo and semi-cargo boats. The *Chile,* which was completed in December last, makes the eighteenth vessel turned out complete by the parent company alone. This, however, does not comprise their total motor output from their engine works. They have orders in hand at present for vessels sufficient to keep them occupied for six years with their present facilities, which provide for the construction of not less than one vessel every two months.

In Great Britain the business is being handled by the Burmeister & Wain (Diesel System) Oil Engine Company, Ltd., in which Lord Pirrie, of Harland & Wolff, is the guiding spirit. Their shops, located in Glasgow, have been laid out with the purpose of manufacturing these engines exclusively. They have already completed the main and auxiliary engines for their sixth vessel, as well as many auxiliary emergency sets for driving dynamos. In addition to the above, they have either under construction or on order engines amounting to over 50,000 indicated horsepower.

The first motor ship in England to be fitted with Burmeister & Wain engines was constructed by Messrs. Barclay & Curle. This was the *Jutlandia,* sister ship of the Copenhagen firm's famous first ship *Selandia,* which was completed just four years ago.

In Norway the licensee is Akers Yard, of Christiania, who have completed their third vessel, and in Sweden Goteborg Nya Verkstadsktiebolog, of Goteborg, who have two vessels to their credit. In Belgium, John Cockrill have the rights and had under construction the engines for one ship when the war broke out.

The following list of shipowners who have ships built, building, or on order, equipped with Burmeister & Wain engines, shows the wide acceptance of this Diesel motor

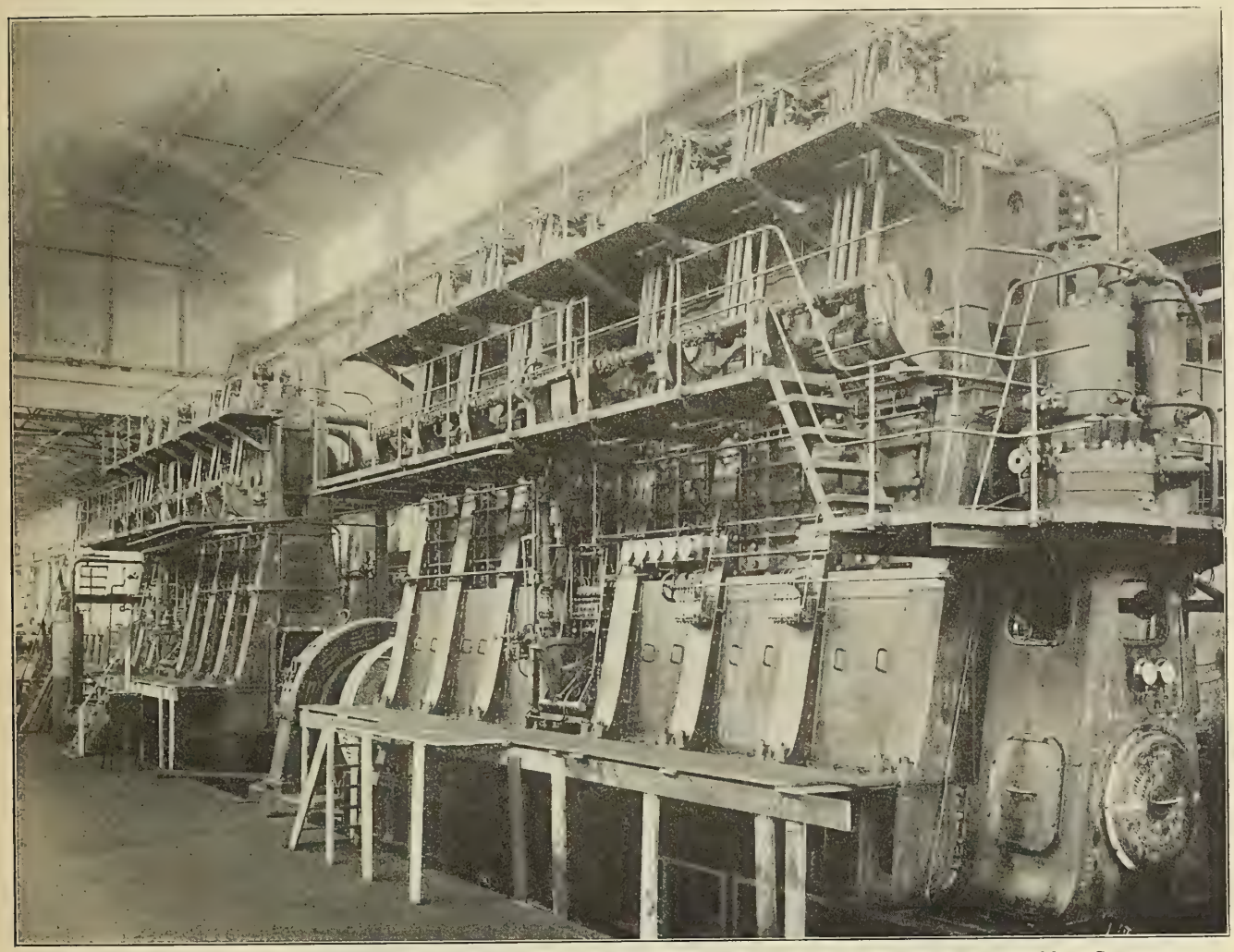
on the other side of the Atlantic: The East Asiatic Company, the Hamburg American Company, the United Steamship Company, the Nordstjernan, the Atlantic Transport Company, the Western Australian Government, Fred Olsen & Co., Elder, Dempster & Co., the Pacific Steam Navigation Company, Frederick Leyland & Co. and Alex. Brostrom & Son.

Burmeister & Wain have within the last year taken up the construction of motors for submarines. These motors are a natural development of their well tried out line of small motors for driving dynamos and compressors.

In a paper read by Mr. I. Knudsen, engineer director of Burmeister & Wain, in July, 1914, before the Northern Merchants Shipping Association at Malmo, Sweden, it was shown, from vessels then in operation and owned by the East Asiatic Company, that a saving of 67 percent in operation was then being effected with the motor ships over the steam-driven vessels owned by the same company. From experience gained with this motor by the East Asiatic Company, they are not only having all new vessels equipped with motors, but are replacing all steam installations in existing vessels with motors.

The Burmeister & Wain Company has never advocated the two cycle engine, having always been firm believers in the four cycle principle from the standpoint of utmost reliability and economy. They have also been conservative in the development of their motors, and have made no large changes at any one time. This is illustrated in the cylinder sizes. There were eight cylinders per engine in the *Selandia* of 21.2 inches diameter by 29.2 inches stroke, with about 160 indicated horsepower per cylinder. This led to building an engine of the same power in six cylinders, which number is now used for all powers. The largest cylinder so far built is 29.6 inches by 44 inches, which gives about 340 indicated horsepower per cylinder, or 4,000 indicated horsepower per ship with twin screws operating at 100 revolutions per minute.

Another development of the engine is the casting of the cylinders in blocks of three, which is an improvement over the earlier design where the cylinders were cast separately. With the new design it is claimed that there is no danger of cracked cylinders, as liners are fitted of special grade cast iron similar to the heads of pistons.



Burmeister & Wain Diesel Engines of the Type to Be Built by the William Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa.

Six "A" frames support the cylinders, and to these are bolted the crosshead guides. These frames are furnished with through strain bolts on either side, which pass from the top of the cylinders to the underside of the bed plate at the bearings. This, it is claimed, eliminates the dangers of broken frames and gives great rigidity.

In the earlier designs the pistons and piston rods were made much longer and were well oil cooled. The pistons are now made only sufficiently long to contain the rings and are cooled with sea water like the cylinders.

The bed plates were first of the box type which made heavy and complicated castings. These are now of the plain open type with sheet metal oil pans fitted.

The new designs show the air compressors self-contained and operated from the end of the crank shafts. In

the earlier engines the first compression up to 300 pounds pressure, at which the air-starting flasks are charged, was done by an outside compressor, there being two in number, one a standby driven off the same engines driving the two dynamos. With the newer arrangement no detached compressor is required, although one driven by an electric motor is installed for use if much maneuvering is to be done. This arrangement of air compressors driven from the main engines, it is claimed, makes for greater reliability. Each is of sufficient capacity to serve both engines in case of the breakdown of one. This also permits of three high speed engines, driving dynamos only, being used instead of two slower speed heavy engines driving compressors and dynamos combined.

Experience of the company has shown that electric motor-driven auxiliaries are more suitable for motor boats and accordingly the newest vessels have cargo winches, steering gear, ballast pumps, bilge pumps, etc., motor driven. One of the three generator sets is kept as a standby, two being sufficient for operating all winches and for electric lighting when in port.

A small oil-fired boiler is installed for heating purposes and for operating a small steam-driven emergency air compressor for filling an air flask should there for any reason be no air pressure on any of the flasks. A small hot bulb engine driving a generator is also usually included in the auxiliaries for use when the ship is lying in harbor and the other auxiliaries are not working.

The illustration shows one of the company's latest and most popular sizes of engines, having 1,550 indicated horsepower per engine or 3,100 indicated horsepower per vessel.

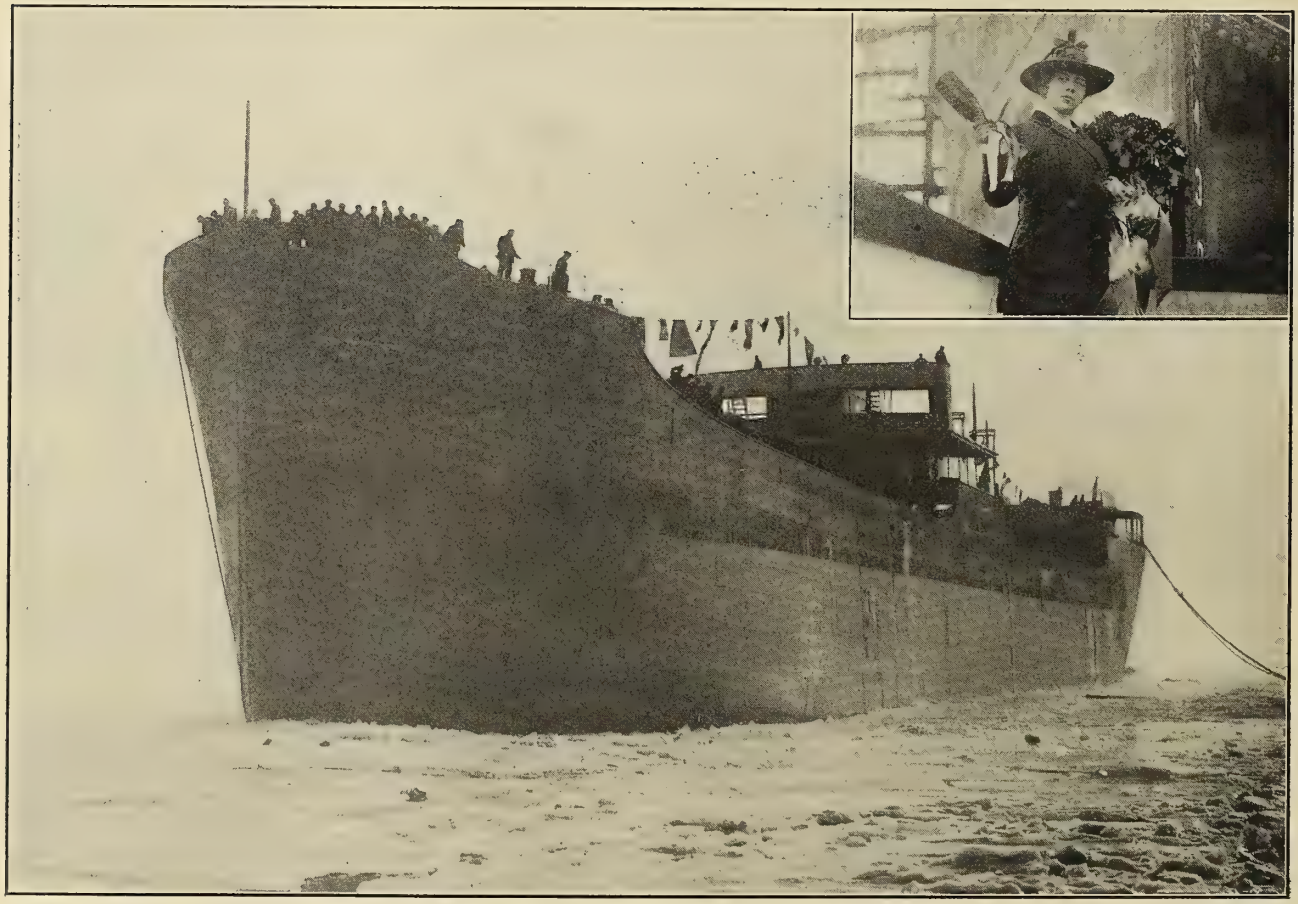
The cam shaft is placed low down and actuated by a chain of gears from the crank shaft. Side by side ahead and astern cams are provided which are brought into play for ahead or astern motion by moving the shaft in a longitudinal direction. The rollers are attached to connecting rods which actuate the rocker arms and are lifted from the cams by means of a layshaft. This is clearly shown in the illustration.

Recent Launchings

The new hospital boat of the St. John Guild, New York, which was described in our February issue, was launched on February 5 at the Jackson & Sharp plant of the American Car & Foundry Company, Wilmington, Del. The vessel was christened by Mrs. John S. Rogers, niece of the donor of the boat, Mrs. A. D. Juilliard.

The passenger and freight steamship *Jalisco,* built for the Mexican Navigation Company for service between New York and the ports in the Gulf of Mexico, was launched on February 7 at the yards of the William Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa. Miss Mary Kerbin Rowan christened the ship. The *Jalisco* is the first of two vessels being built for the Mexican Navigation Company. Each vessel will be 317 feet long overall, 45 feet beam and 22 feet depth of hold. Accommodations will be provided for fifty first class passengers.

The oil tanker *New York,* sister ship of the *Texas,* described in our February issue, was launched from the yards of the Fore River Shipbuilding Corporation, Quincy, Mass., on February 19. The vessel was christened by Miss Elizabeth Giezendanner, of Houston, Texas. The *New York* is 431 feet 10 inches long overall, 56 feet beam with a carrying capacity of 2,500,000 gallons of oil.



Launch of the Texas Company's New Oil Tanker *New York.* Insert Shows the Vessel's Sponsor

New York Branch of the American Society of Marine Draftsmen Holds Its First Annual Banquet

Over one hundred and twenty-five members and guests of the New York Branch of the American Society of Marine Draftsmen assembled at the Hotel Breslin, New York City, on Saturday evening, February 19, for the first annual banquet of this branch of the society. Mr. P. R. Hichborn officiated as toastmaster, calling attention to the fact that the training and education of marine draftsmen are on a plane with that of other professional men and that the marine draftsmen should be better known and recognized as professional men and receive the compensation commensurate with their standing as professional men. He pointed out several glaring examples of injustices to the marine draftsmen employed in government service. In the first place, the Workman's Liability Act takes no account whatever of the draftsman. While the humble riveter in the yard is protected by the government in cases of accident, no such protecting arm is extended to the draftsman, although he may be exposed to as great dangers in the performance of his duties on the vessels or in the yard. Other injustices pointed out were the lack of an effective system of promotion and retirement in the navy yards and the inadequate compensation given for increased experience on the part of the draftsman. It was pointed out that when in emergencies applicants for positions as ship draftsmen are not required to pass an examination, the chief draftsman should have the right to pass upon the fitness of such applicants.

Among the other after-dinner speakers were Naval Constructor J. D. Bailey, U. S. N.; Lieutenant Commander Earl P. Jessop, U. S. N.; Commander S. H. R. Doyle, U. S. N., senior engineer officer of the battleship *Arizona,* and Honorable Joseph B. Flynn of Brooklyn, member of Congress. Congressman Flynn stated that the pay of government draftsmen was about 25 percent less than that of draftsmen in private establishments. He assured the draftsmen, however, that the matter of increased compensation is impending before Congress and that some recognition is certain to be given.

Banquet of New York Branch of American Society of Marine Draftsmen, Hotel Breslin, New York, February 19

PERSONAL MENTION

Martin C. Bronk, erecting engineer for the United States Government, has been appointed chief engineer of the tug *Colonel Thayer,* at Keyport, N. J.

James H. Allen, captain of the Government tug *Colonel Thayer,* at Keyport, N. J., and one of the best-known river men on the Hudson River, died suddenly on January 21.

Thomas Fogarty, a retired marine engineer, formerly on the Troy (N. Y.) ferries, has purchased a hotel at Saratoga Springs, N. Y.

William Schiler, oiler on the steamer *Iroquois,* of the Manhattan Line, New York, has been promoted as first assistant engineer of the steamer *Mohawk,* of the Manhattan Line.

Charles Hundley has been appointed chief engineer of the river steamer *Slack Barrett,* which recently left Cincinnati, Ohio, for Portsmouth, Ohio, in command of Captain J. H. Brown. George Watson is first assistant engineer of this steamer.

Jesse Allen is chief engineer of the river towboat *Crown Hill,* which recently left Cincinnati, Ohio, commanded by Captain Charles Cole, for the Guyan River for a tow of timber. Charles Harris is first assistant engineer of the vessel.

Captain W. M. Hart, of West Roxbury, Mass., will command the coastwise steam collier *Bristol,* just completed by the New York Shipbuilding Company, Camden, N. J. Captain Hart was formerly in command of the Boston-owned steamer *Norfolk,* engaged in the coal trade between Chesapeake Bay and New England ports.

Captain Thomas V. Kelly, employed by the Erie Railroad Company as master of harbor craft, died from heart disease in Brooklyn on January 18, aged sixty-seven years.

William B. Ruggles, for more than twenty years a prominent engineer in New York and recently engineering adviser to the Russian government, died recently of pneumonia, at his home in Bergen Point, N. J., aged fifty-five. Mr. Ruggles was the founder and head of the Ruggles-Coles Engineering Company, New York.

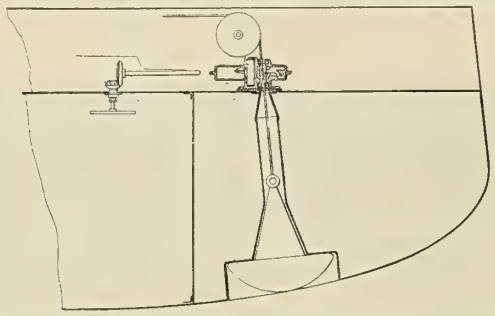
SELECTED MARINE PATENTS

The publication in this column of a patent specification does not necessarily imply editorial commendation.

American patents, compiled by Delbert H. Decker, Esq., registered patent attorney, Millerton, N. Y.

1,158,160. ANCHOR CABLE-CUTTING APPARATUS FOR SUBMARINE BOATS. JOSEPH BARRAJA-FRAUENFELDER, OF BRIDGEPORT, CONN., ASSIGNOR TO THE LAKE TORPEDO BOAT COMPANY OF MAINE, OF BRIDGEPORT, CONN., A CORPORATION OF MAINE.

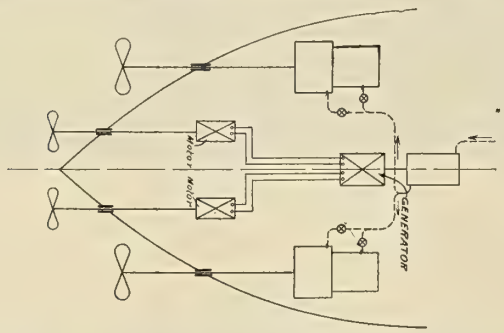
Claim 3.—In combination with a submarine boat, provided with a superstructure and having an anchor well in the main hull thereof; an anchor weight normally housed within said well, and an anchor cable connected to said weight and extending from said superstructure, of an



apparatus for cutting said cable, said apparatus comprising a fixed and a movable cutting blade, means operable from within the boat for actuating said movable blade, and a protecting casing or housing for said cutting blades. Eight claims.

1,158,617. SHIP PROPULSION. HEINRICH ZOELLY, OF ZURICH, SWITZERLAND, ASSIGNOR TO ESCHER, WYSS & CO., A CORPORATION OF SWITZERLAND.

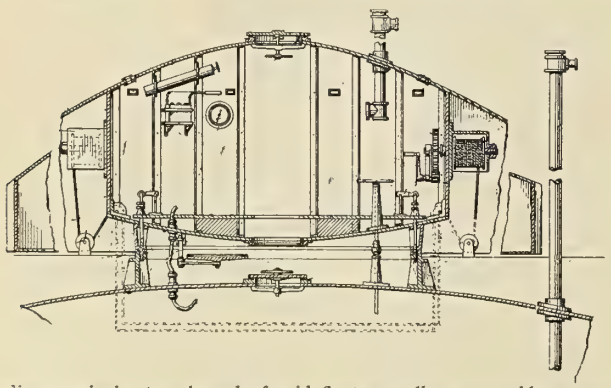
Claim 10.—In combination with a ship, a dynamo turbine and direct-connected dynamo, a propeller shaft, an electric motor connected to said dynamo for driving said shaft, a second propeller shaft and a multi-



stage propeller turbine, direct connected thereto, means for delivering exhaust steam from said dynamo turbine to a higher pressure stage of said propeller turbine when the ship is running at cruising speed than when running at full speed. Ten claims.

1,159,683. SAFETY FLOAT FOR SUBMARINES. HENRY E. KELLER AND HARRY M. SIEDSCHLAG, OF THE UNITED STATES NAVY.

Claim 6.—The combination with a submarine, of a float attachable thereto and releasable therefrom, means operable from within said float for controlling separation thereof from said submarine, said means in-

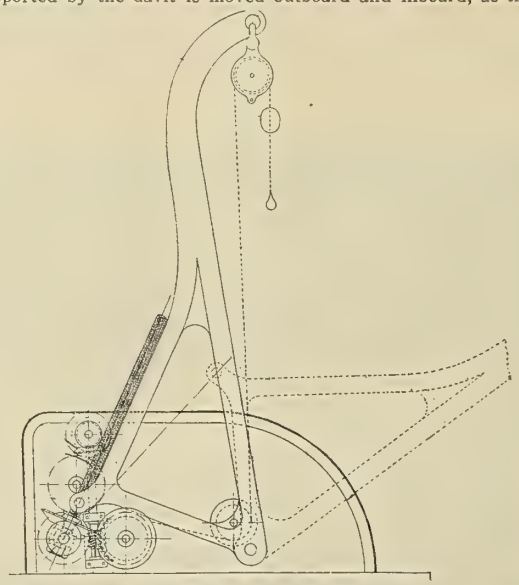


cluding a winch at each end of said float, a pulley removably mounted at each end of said float, flexible connections extending from each winch for training over the adjacent pulley subsequent to an intermediate connection with said submarine, means for removably securing the free extremity of each of said flexible connections to the opposite end of said float, and means for disconnecting either or both of said pulleys in permitting the flexible connections from the corresponding winch or winches to extend through to opposite ends of the float. Ten claims.

British patents compiled by G. F. Redfern & Co., chartered patent agents and engineers, 15 South street, Finsbury, E. C., and 10 Gray's Inn place, W. C., London.

20,965 OF 1914. SHIPS' DAVITS. G. TURNBULL, 53 DEVONSHIRE ROAD, BIRKENHEAD, CHESTER.

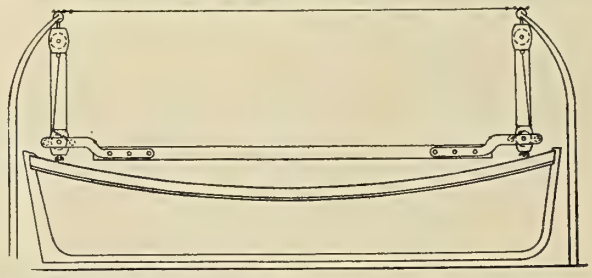
This invention has reference to ships' davits of that kind which is of bell crank lever or triangular form at the lower portion, and is hinged at the outer lower part of the triangle or bell crank portion and is moved about this pivot or hinge by screw and nut gearing, and when worked, the boat supported by the davit is moved outboard and inboard, as the case



may be; and the object of the invention is to provide davits and a mode of operating them, of this kind, which is simple and convenient and can be readily operated.

20,699/14. APPARATUS FOR RAISING AND LOWERING SHIPS' BOATS. H. HUGHES, OF 3, HAZEL ROAD, BIRKENHEAD, CHESHIRE.

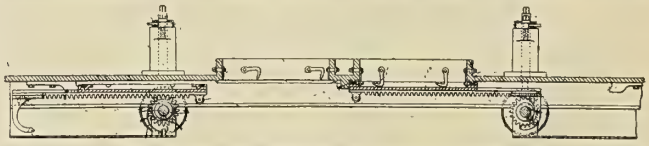
This invention relates to that type of raising and lowering apparatus for ships' boats in which the boat is suspended from the respective davit heads by fore-and-aft gear comprising a block fixed to the davit head and a block connected by disengaging gear with the boat, the invention



having reference more particularly to that type of such gear in which the two lower blocks are connected together by a fore-and-aft spar, whereby the bottom sheave blocks when disengaged from the boats, are prevented from rotating about vertical axes and thus twisting the tackles, and also from tumbling over about horizontal axes and thereby jamming the ropes in the blocks.

6,547/15. HATCHES FOR SHIPS AND LIKE VESSELS. W. O. JONES, OF 5, SHEFFIELD PLACE, MUMBLES, GLAMORGANSHIRE.

This is a modification of the self-opening hatch patented under No. 25,121 and dated November 4, 1913. Whereas that patent related to a pivoted hatch, which, on being closed, tensioned a spiral spring contained within a housing on the hatch, the hatch thus being automatically opened



when released, the present modification relates to a sliding hatch of the type which, on being closed, tensions a spiral spring as before, the motion of the hatch tensioning the spring through the medium of a rack and pinion, a cog-wheel and chain, or the like. According to the invention, means such as a bevel gearing wheel in engagement with a similar wheel on a shaft are provided for closing the hatch against the strength of the spring, which constantly tends to open it. The strength of the latter is also capable of regulating by means of the bevel gearing, the pinion or cog-wheel on the spring returned shaft being detachably secured for this purpose. Pawl and ratchet means are also provided for normally preventing the return of the hatch cover under the action of the spring.